DOCUMENT RESUME

ED 262 201 CE 042 582

AUTHOR Sticht, Thomas G.
TITLE Literacy and Human Resources Development at Work: Investing in the Education of Adults to Improve the Educability of Children. Professional Paper 2-83.
INSTITUTION Human Resources Research Organization, Alexandria, Va.
REPORT NO HumRRO-PP-2-83
PUB DATE Feb 83
NOTE 52p.; This report is an extension of an address to the National Academy of Education meeting (Toronto, Ontario, October 1980).
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Academic Achievement; *Adult Basic Education; Adult Literacy; Adult Reading Programs; Cost Effectiveness; Delivery Systems; Educational Attainment; Educational Benefits; Educationally Disadvantaged; Educational Needs; Educational Practices; Educational Research; Employment Potential; Industrial Training; Influences; Job Skills; *Labor Force Development; *Literacy Education; Needs Assessment; *Parent Child Relationship; Parent Role; Research Needs; *Training Methods
IDENTIFIERS *Job Related Reading

ABSTRACT

Research indicates that many illiterate youth and adults who become parents are unable to transfer high levels of oral language skills or to model literacy use for their children. Consequently, their children begin school without the readiness skills necessary to learn to read and thus continue a cycle of family illiteracy and employment problems. Studies indicate that among the benefits that could be attained from employer-sponsored literacy training programs for marginally literate youth and adults while developing their literacy, oral language, and learning skills the following human resources-related benefits would be attained: (1) the value obtained from education dollars could be doubled, (2) youth and adult employment problems could be relieved, and (3) children's ability to achieve in school could be improved. Research studies have confirmed that literacy skills and their use have a direct impact on proficiency and productivity in the workplace. Literacy programs that focused training directly on teaching students how to perform job-related reading tasks resulted in improvements in both general and job-related literacy, with even brief programs having significant impacts on workers' literacy skills. In light of the intergenerational benefits to be gained from job-related literacy programs, researchers should seek cost-effective ways for employers to implement such programs. A brief list of references concludes the report. (MN)

Professional
Paper
2-83

HumRRO-PP-2-83

HumRRO

ED262201

Literacy and Human Resources Development at Work:

Investing in the Education of Adults to Improve the Educability of Children

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This report is an elaboration and extension of an invited address to the members of the National Academy of Education meeting in Toronto, Ontario, Canada in October, 1980.

February 1983

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PREFACE

This report is an elaboration and extension of an invited address to the members of the National Academy of Education meeting in Toronto, Ontario, Canada in October, 1980. The Executive Summary of this report appears in the Proceedings of the National Academy for 1980. However, because of the current wide-spread interest in youth and adult unemployment, undereducation, and the need for retraining in the face of job displacement, it was decided to make the entire report more generally available. The research discussed in the report was conducted by Dr. Thomas Sticht in association with various colleagues at HumRRO, foremost of whom were John Caylor, Richard Kern, Lynn Fox, Robert Hauke, Diana Welty Zapf, Wendy McGuire, and Nina McGiveran. The report was prepared by Mrs. Alice Thompson. Opinions and interpretations are those of the author and do not necessarily reflect the official positions of the Human Resources Research Organization or the various agencies that have sponsored one or another aspect of the research reported herein.

EXECUTIVE SUMMARY

In this paper I have presented a case for the need for research and development efforts to find cost-effective methods for permitting employing organizations to put marginally literate youth and adults to work, while at the same time providing education and training to increase the literacy and learning skills of these employees.

The argument included first a discussion of the nature of literacy, with an emphasis upon the relationship of oral to written language skills. It was noted that:

(1) Despite the perennial arguments about "methods" among reading theorists and practitioners, a consensus has been found among the three major approaches to reading—the code, meaning, and psycholinguistic approaches. Proponents of all three approaches subscribe to the understanding that—

(a) Oral language skills develop to a fairly high level prior to the development of written language skills.
(b) Oral and written languages share much the same vocabulary and syntax.
(c) Beginning readers draw upon their knowledge of oral language in learning to read.

(2) Many children arrive at kindergarten or the first grade of school without the oral language skills and conceptual knowledge needed to acquire higher levels of literacy in school.

(3) These children frequently fall behind in school and later drop out, and become the marginally literate and marginally employable youth and adults of concern in this paper.

(4) Many of these youth and adults become parents of children and are unable to transmit high levels of oral language skills or to model literacy uses for their children, and so their children show up for school prepared to recapitulate the failure of their parents, and the cycle repeats itself again and again.

Attempts to break this cycle have focused on early childhood and elementary school-based intervention programs. Efforts to further develop the literacy skills of youth and adults have been and are trivial in comparison. A reason for this situation was found in prevailing labor market concepts of human resources development and utilization. It was noted that:

(5) Our economic system allocates childhood and youth as times for human resources development, and provides the K-12 education system as the primary means for literacy and other cognitive skills development.

(6) As adults, however, the economic focus is upon the utilization of human resources for productive work.

(7) Investment in adult literacy development in work organizations is counted against productivity, because it places people in a training rather than a production position.

(8) Because the improvement of adult literacy skills requires an investment in human resources development beyond the K-12 years and curriculum, programs of adult literacy development are avoided. When implemented, they are considered as "remediation" rather than development; they are expected to be of limited duration, fast-acting, and far-reaching, and to bring about improvement not only in literacy skills, but in job performance, parenting, community participation, etc., etc.

(9) Because literacy skills development is "the business of the schools," there is a tendency to avoid the adult's problems. Program planners tend to chastise the schools and to try to solve the problem "at the source" by dint of extra resources for preschool and in-school special programs for children.

This line of reasoning has been noted here to provide a basis for better understanding of why not much has been done to try to break the cycle of illiteracy and marginal literacy by focusing on programs for youth and adults. Evidence was reviewed to suggest that:

(10) More highly educated parents tend to produce children who achieve higher levels of literacy. This held true over a 25-year period in data from the National Assessment of Educational Progress for 1972, and for a recent national survey conducted by the Department of Defense in establishing norms for the Armed Services Vocational Aptitude Battery.

(11) More highly educated parents transmit literacy intergenerationally via oral language skills and the modeling of literacy skills (Hess and Holloway, 1979), and hence,

(12) If we could find ways to cost-effectively employ marginally literate youth and adults while developing their literacy, oral language, and learning skills, we could get double value from education dollars and relieve both youth and adult employment problems, as well as improving their children's abilities to achieve in school. (Karnes et al., 1970, report on a program in which parents were offered special education in child rearing and political activism. The program resulted in the parents improving their own life circumstances. It also produced a 15-point improvement in their children's IQ scores compared to a non-treatment group, and a 38-point improvement over the IQs of their older siblings who grew up before their parents received the special education!)

Research toward the development of a cost-effective system for adult human resources development in a work organization was reported, using the Department of Defense as a case study. Aspects of this research examined the uses of oral and written language in military jobs, the nature of job-literacy tasks, and the development of job-literacy programs. These programs included one in which the literacy training was integrated into the job technical training programs in such a way that both literacy and job training were accomplished more effectively than either prior to the development effort. Subsequent adaptation of this approach by the Navy resulted in a 32 percent reduction in attrition of less literate personnel from technical training.

The job-related literacy approach has been institutionalized in policy letters by the Secretaries of the Army and the Navy, and both services are currently involved in extensive efforts to produce such programs.

The research methods for the study of job literacy in the Department of Defense have been applied to the study of civilian jobs by Mikulecky (1981) and Diehl and Mikulecky (1980). Across the Department of Defense and civilian studies, findings are relevant to questions of how well the schools prepare students for accomplishing the

literacy tasks of work, and how school-related and work-related literacy tasks differ. These findings include:

(13) Students who achieve well in schools generally have the literacy skills needed to perform job reading tasks.

(14) Job reading tasks are more likely to involve reading to do something, while school and technical training programs emphasize reading to learn something.

(15) Reading-to-do tasks are generally less difficult than reading-to-learn tasks. Reading-to-do tasks, such as using reference materials, looking up significant facts, and using graphic aids, are performed quite well by adults, whereas tasks such as critical reading or drawing inferences, processes involved in reading-to-learn, are performed less well by adults (and all other age groups, for that matter). These data suggest that, while students are learning the literacy skills needed to do a job, they are too frequently not acquiring the skills needed to learn a job. Many job technical training programs, such as in community college courses or in industry or government, pose an initial demand for learning by literacy that exceeds the literacy demands of the job itself. Too often, they may pose an insurmountable hurdle for less literate youth and adults.

(16) Information-seeking behavior on the job is affected by literacy skill. Less literate workers tended to seek information about job tasks by asking others, whereas more highly literate workers sought job-related information more by reading than by asking others. Less literate workers sought a total of less information than did the more highly literate workers when use of oral and written language sources were considered together.

(17) Job performers who used written language resources (technical manuals) performed job tasks more effectively than those who did not. Thus, literacy and its use have a direct impact on proficiency and productivity.

(18) Literacy programs that focused training directly on teaching students how to perform job-related reading tasks resulted in improvements in both general and job-related literacy, with gains in the latter being two to three times greater than in the former. This suggests that literacy is not altogether a "general" skill. Rather, specific knowledge (vocabulary, concepts, principles, rules) is needed for performing various reading tasks and improvements in the latter can be achieved without making much improvement in tests of "general" literacy. This raises the research question of what is general about general literacy, and suggests the need for "testing to the teaching" in program evaluation studies to determine if what is being taught is being learned.

(19) Brief programs of job-related literacy can foster significant increases in job-related literacy skills. However, increments of two or even three grade levels on normed tests are not sufficient when entering skills are at the third or fourth grade levels. For this reason we have sought ways to develop cost-effective long-term human resources development programs in operational work settings so that marginally literate adults can be productively employed, while their literacy, language, and learning skills are systematically improved. If successful, this type of intervention on adults may have significant impact on their children through the intergenerational transfer of literacy.

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Literacy and Human Resources Development at Work:

Investing in the Education of Adults to Improve the Educability of Children

INTRODUCTION

This paper discusses research to understand the nature of literacy, the role of literacy in the world of work, and methods for improving literacy skills of adults and their children. The research aims to discover how to design, for organizations and industries, human resources development systems that will permit basic literacy and learning skills of adults to be developed in a manner that both supports the organization's mission and is cost-effective from that organization's point of view.

The paper proceeds as follows: First, a discussion of the nature of literacy presents a developmental model that shows the major components involved in achieving literacy in the typical case of the child who grows up in our literate society. Secondly, the literacy model is drawn upon to argue for research and development to provide youth and adults with greater access to quality human resources development programs having literacy development as an integral component. The argument centers around the concept of the intergenerational transfer of literacy from parent to child. A review of research bearing on the validity of the intergenerational transfer hypothesis sets the stage for the work-related sections of the paper.

The third part of the paper discusses the concepts of human resources development in school and work settings. It suggests the need for research to identify methods for long-term development of literacy and learning skills of youth and adults in various organizational settings outside the schools. Such programs would permit people to be productively employed while they acquire the literacy skills needed for their own advancement, the advancement of the organization employing them, and the intergenerational enhancement of the cognitive skills of their children.

The fourth part of the paper discusses research on the uses of literacy in job settings. Concepts from the theoretical understanding of literacy are drawn upon in formulating the research on work-related literacy. This illustrates the heuristic value of the conceptual understanding of literacy in guiding the practical study of literacy tasks performed on the job.

The job-related literacy research discussed was conducted for the Department of Defense and its agencies, the Army, Navy, and Air Force. The fifth part of this paper briefly describes research to design cost-effective approaches to literacy development within the military services. This discussion illustrates, in a case study, the type of research that is needed if we are to find ways to develop the literacy and learning skills of youth and adults, while they are productively employed.

Finally, a brief section discusses applications of the military work in civilian settings and points out why the time may be right for reconsidering policies of childhood and adult education.

PART I:
A DEVELOPMENTAL MODEL OF LITERACY

Developing cost-effective literacy and human resources development systems in work settings requires formulating some concept of literacy that can serve as a heuristic device in the planning, conduct, interpretation, and synthesis of research. For these purposes, I have found it useful, in conducting research and development projects on the nature and use of literacy skills at work, to follow a macromodel of the major components and processes involved in developing such skills.

Figure 1 presents, in schematic form, an overview of the major concepts included in the developmental model of literacy. Before addressing the details of the model, several orienting comments regarding Figure 1 are in order. First, the figure is meant to portray a developmental sequence when examined from left to right. The sequence begins with the newborn infant, and goes through stage 4 in which literacy skills are functional. The broad arrowhead on the far right is meant to imply continued development over the lifespan. The development of literacy, language, and knowledge is a lifetime activity.

Examining Figure 1 from top to bottom, the top series of boxes is meant to represent the environment in which the person exists. This is the environment "outside the head". This external environment makes available information displays in the form of structured energy (mechanical for hearing; electromagnetic for seeing) that the person can explore and transform into internal representations of the external information. These internal representations are developed by the processes in the second series of boxes labeled, on the far left, Information Processes in Working Memory. These processes go on "inside the head", and merge information picked-up from the external information displays with information picked-up from the third series of boxes, labeled on the far left as Long Term Memory. Thus, the processes in the working memory are used to pick-up and merge information from outside the brain with information in long term memory inside the brain to construct an internal representation of the world at a given time.

At the top of Figure 1 there are references to four stages. Stage one refers to the newborn infant who is considered to be innately endowed with the Basic Adaptive Processes involved in sensory/perceptual processes such as hearing and seeing, etc., motor movement, and cognition, including the processes needed to acquire information, mentally manipulate it, store it in memory, form knowledge structures out of it (e.g., images, facts, concepts, principles, rules, and, after considerable education, large structures of subject matter areas such as mathematics, biology, etc.) and retrieve and represent the information in various ways. In stage 1, these processes are assumed to work more or less automatically without conscious control.

Stage 2 represents the emergence of conscious control over information pick-up and manipulation. This active process of attending to information distinguishes <u>listening</u> from hearing, and <u>looking</u> from seeing, as information pick-up processes. Listening and looking build internal representations that may be called <u>images</u> (though at times this general term is divided into echoic and iconic images for listening and looking, respectively). Images may also be constructed from data stored in long term memory. These

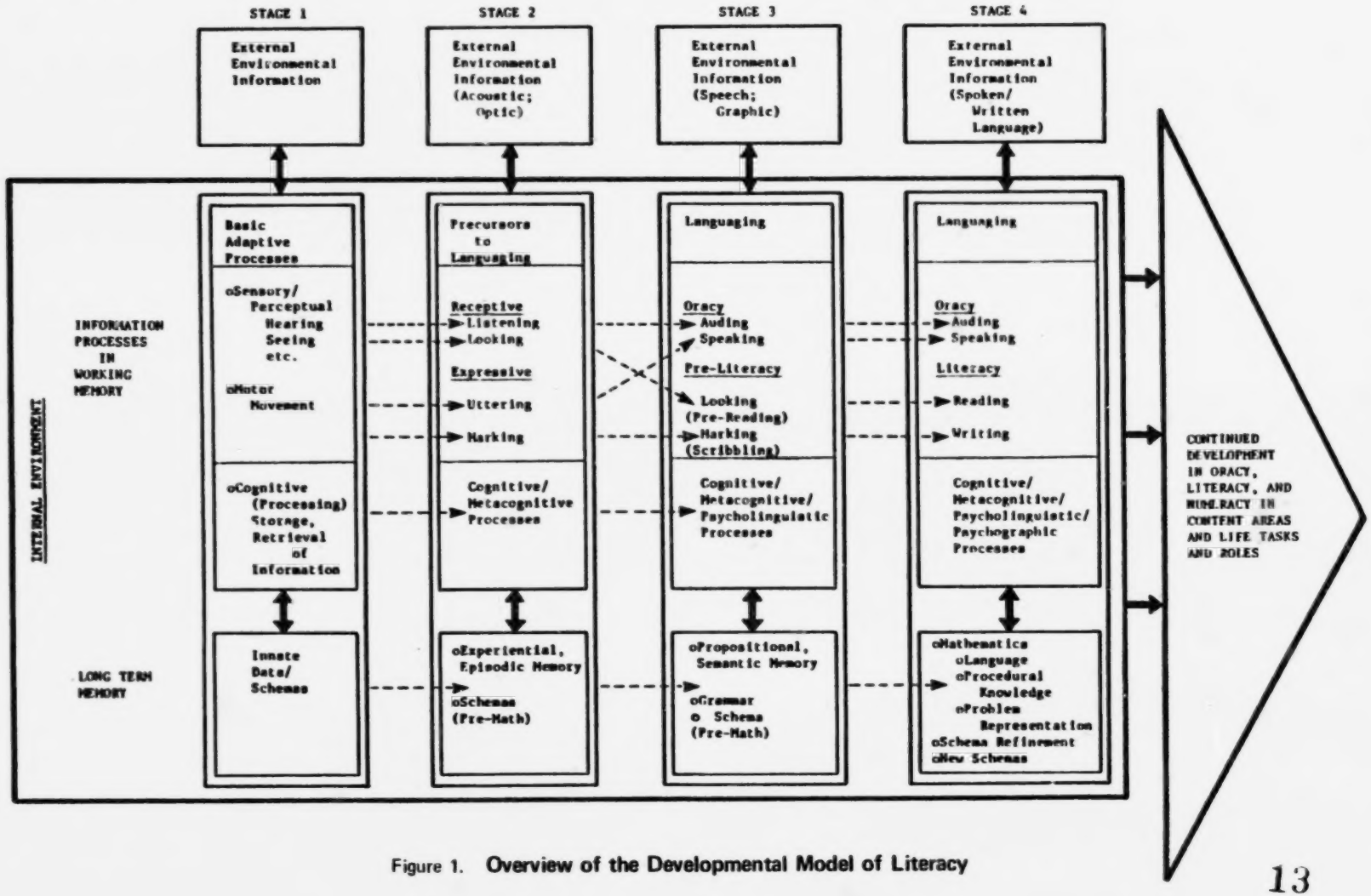

Figure 1. **Overview of the Developmental Model of Literacy**

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internal imaging processes are frequently assessed in aptitude tests as "spatial perception" or "mechanical comprehension" in which it is necessary to mentally visualize and rotate cog and gear assemblies to determine what effect this movement might have on some other gear.

Stage 2 also introduces the concept of active or working memory, which is defined by the occurrence of consciously controlled information processing activities. Working memory is a limited memory that can easily be overloaded (e.g., attending to 2 or 3 things at once is difficult—if not impossible). Many of the information processing activities the person acquires will be techniques to overcome active memory limits (e.g., repeating information to oneself keeps the information in active working memory until it can be applied).

Stage 3 represents the development of language processes out of earlier processes and knowledge stored in long-term memory. In developing oral language, the listening process is used in attending to spoken language to learn the words and grammar of language. Thus, listening plus languaging, occurs simultaneously. This joint occurrence is given the special name of auding. On the production side, the joint occurrence of uttering (making sounds through the mouth) with the production of word forms from the language pool, and stringing the word forms together to make sentences using the rules of grammar, produces the special process called speaking. Auding and speaking comprise the oral language information reception and production skills. Speaking is used to represent information that the person has in his or her mind "outside the head" and in the acoustic medium, while auding is used to pick-up and decode speech information displays into knowledge in the mind of the listener.

In stage 4, the information processing skills of looking and marking are used to learn a representational system which, in many respects, represents the spoken language in a different medium—light—and in a more or less permanent graphic display: the written language. Looking at written language and transforming the written language into meaning is called reading. Writing is the special use of marking skills to produce graphic language (and other symbols and symbol systems).

In the typical case, people develop a fair amount of competence in oral language before they are exposed to formal instruction in reading in the elementary grades. The written language skills build upon the earlier developed oral language skills and add new vocabulary and concepts, as well as special knowledge about how to represent information in the graphic medium, to the person's knowledge base. In turn, learning new vocabulary and conventions of language through reading and writing enlarges the person's oral language abilities. The large arrow at the far right in Figure 1 is meant to represent the notion that the development of oral and written language ability may continue indefinitely. As mentioned earlier, learning to read can take a lifetime.

A major component of Figure 1 is the person's long term memory. The long term memory contains all the knowledge developed by the person in interaction with the environment, including the processes the brain invents to overcome limitations in working memory and other aspects of its functionings (such as retrieval processes for remembering information). Much of the knowledge acquired by the person will not be understood in consciousness (for example, the rules of grammar). Rather, it will be unconsciously used to accomplish tasks such as developing language competency and comprehending the events of the world. In addition to the general world knowledge and processes that are in the mind, though not accessible to conscious understanding without considerable analysis, the memory also contains the language knowledge (words and grammar) that can be used to represent information that arises from experience in the world (e.g., bodies of knowledge about parts of the body, houses, neighborhoods—sometimes called "schema" in cognitive science terms (Rumelhart, 1980) and from didactic instruction, as in training programs.

The model holds that the development of the oracy skills of speaking and auding is built upon the development of the prelinguistic cognitive content through intellectual activity which I call conceptualizing ability. It is important that it be understood that this early, prelinguistic cognitive content, or knowledge, will form the foundation for the acquisition of new knowledge over the person's lifetime.

Much of this knowledge will remain personal, and will not be explicitly represented in language for communication to others. Nonetheless, such personal, tacit knowledge, which includes perceptual learnings and general knowledge of "how the world works," will be absolutely necessary for learning to comprehend the spoken, and later the written, language. This reflects the fact that language is selective in the features and concepts chosen to be represented. We may think of language as producing a verbal figure, which can be comprehended only in terms of its relationship to a nonlinguistic conceptual ground of "world knowledge." A simple illustration of the role of personal or "world knowledge" in literacy training is seen in the recommendation to give students experience with objects and events in the world through field trips, demonstrations, movies, etc., before they read about them. This approach provides an experiential base or "world knowledge" which will permit a deeper comprehension of the words and concepts the students read.

A final aspect of the model is that it recognizes that, on the one hand, the literacy skills of reading and writing utilize the same cognitive content used in auding and speaking, plus the special decoding and encoding skills of reading and writing. On the other hand, the very nature of the written language display—characterized by being more or less permanent, being arrayed in space, and utilizing the features of light (color, contrast)—makes possible the development of skills and knowledges entirely different from those involved in oral language.

The model incorporates the role of prelinguistic looking and marking abilities as contributors to later utilization of the visual display of written language in conjunction with lines, white space, and color to develop graphic tools such as matrices, flow charts, color coded graphs, and the like. These tools combine with written language and non-language graphic symbols, such as arrowheads and geometric figures, to produce analytical products beyond those obtainable through the fleeting, temporal oral language.

The point to be emphasized is the fact that much of the acquisition of literacy is not simply learning to read; that is, it is not just learning a language system that can be substituted for the oral language system. Rather, a large part of learning to be literate, and perhaps the most important part for acquiring higher levels of literacy, is learning how to perform the many tasks made possible by the unique characteristics of printed displays—their permanence, spatiality, and use of light.

PART II:
THE INTERGENERATIONAL TRANSFER OF LITERACY

The relationship between oral and written languages discussed in the developmental model has implications for policy on adult and childhood intervention programs aimed at breaking cyclical patterns of low educational achievement and low economic achievement. In this cycle many students who enter our public schools come from homes in which they have been unable to acquire the minimal competencies needed to succeed in school; many of these students become dropouts and academic failures of the school system; they then become the unemployed or underemployed, lower socioeconomic status, marginally literate parents of a new generation of students who, in their turn, will enter the schools without the minimum competencies needed to succeed, and the cycle of marginal literacy and marginal living will repeat itself.

Current attempts to interrupt this cycle focus resources in compensatory programs operated in the public schools, where it is hoped that the disadvantages of the home can be overcome by extra effort in the classroom. While the expenditure of billions of dollars in such compensatory efforts has perhaps made some improvements in elementary grade achievement (Beller, 1973), the effects have not been as dramatic as the differences among children when they show up for the first grade. Furthermore, the effects seem to diminish by the middle grades (Bronfenbrenner, 1975, p. 592).

At least one major reason for the limited effectiveness of national policies to improve the educational achievement and subsequent employability of children from marginally literate homes is that they do not recognize the role of the education of the parent in the education of the child. Repeatedly, studies show that low-level oral and written language skills of the parent are recapitulated in the skills of the children—even before these children begin schooling.

The interrelationships of parents' and children's educational achievement are evident in data from the National Assessment of Educational Progress (NAEP, 1972). Figure 2 shows how 9-, 13-, and 17-year-olds and young adults (ages 26-35) whose parents had no high school, had some high school, were high school graduates, or had post-high school education performed on a variety of literacy tasks. Clearly the parents' educational achievement was strongly related to the subsequent achievement of literacy by the children. This holds true over the 25 years spanned by the birth dates of the adults and the 9-year-olds, a period in which most of the preschool and elementary school intervention programs were initiated and carried out in our nation.[1]

While drawing straightforward conclusions from data like those presented in Figure 2 is always risky, because of unknown factors such as possible differences in native abilities between parental education groups, other data indicate that less well-educated adults do

[1] A recent report that profiles the literacy skills and vocational knowledge of our Nation's youth (ages 18-23) shows that mother's education level is one of the strongest correlates of achievement on the Armed Services Vocational Aptitude Battery (Profile of American Youth, Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), March 1982.

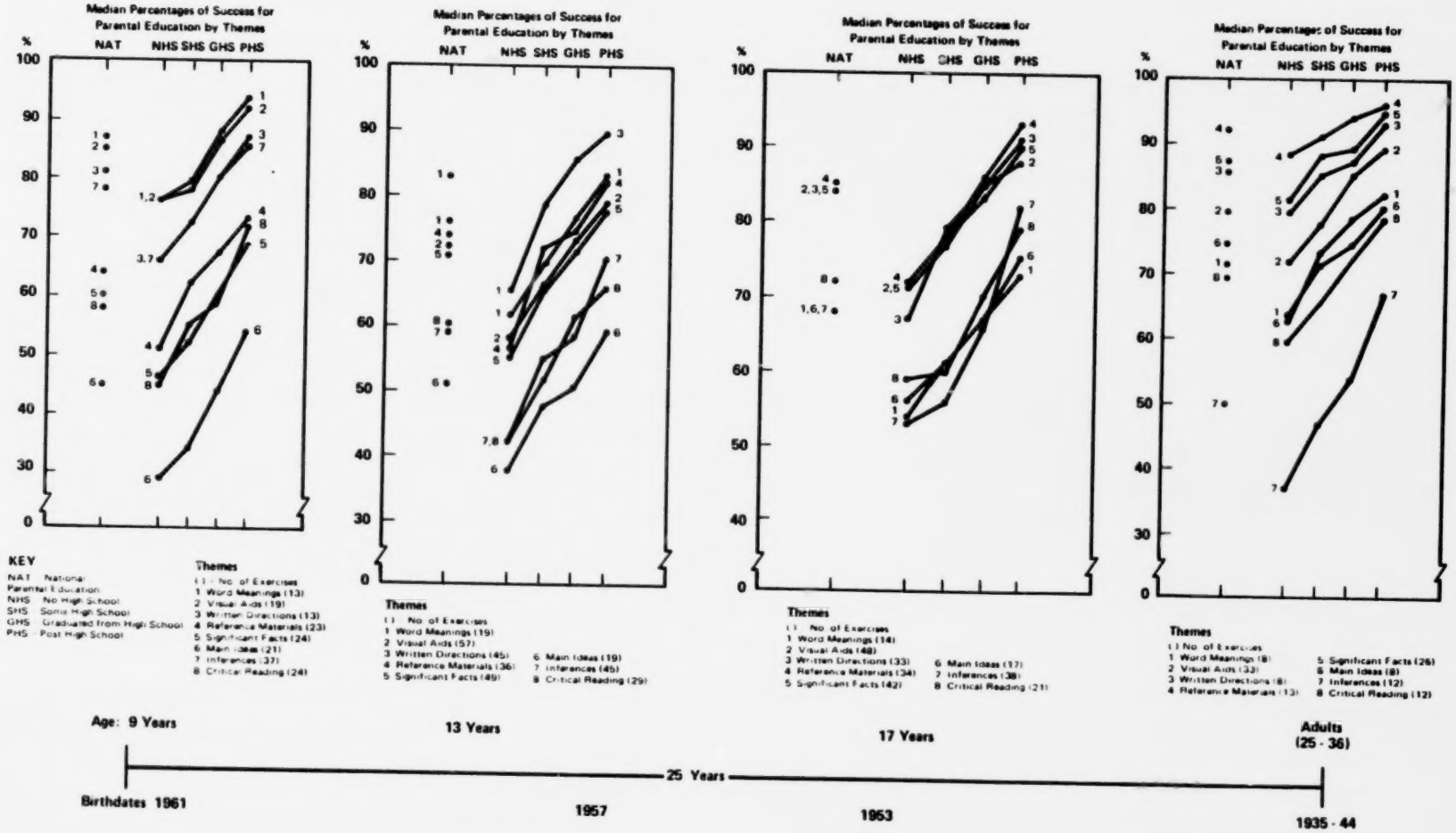

Figure 2. **Data From the National Assessment of Educational Progress Showing Relations of Parent Education Level to Reading Task Performance**

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not perform reading tasks as well as better educated adults (Harris and associates, 1970; Golden and Birns, 1976). Adult poor readers are also likely to have low oral language vocabulary skills and have difficulty comprehending orally presented passages (Sticht, 1982). It seems reasonable to suppose that such adults will be unable to promote extensive vocabulary development in their preschool children, or to provide them with opportunities to listen to orally read stories to develop passage comprehension abilities. It is well documented that less educated homes offer fewer opportunities for the preschool child to observe role models performing reading tasks and to listen to extended, elaborated spoken discourse like that encountered in the schools (Hess & Holloway, 1979).

In other words, such children are less likely to listen to "literate" speech than children from homes where highly literate parents "speak print" to a large degree, and where the parent reads, goes to the library, and in general makes a great deal of functional use of the written language. We can suppose that by all these mechanisms the more literate parents transfer aspects of literacy to their children, and that such transfer is lacking in the homes of the less well-educated parents.

Oracy to Literacy Developmental Sequence

If children come to school with poorly developed oral language skills and knowledges, the chances are that they will have a difficult time acquiring good written language skills. This reflects the role that oral language plays in reading. A recent review of the relationships between oral and written language has revealed that, despite the continuing debate over which "approach" to reading is best, there is agreement among the three major positions—code, meaning, and psycholinguistic—as to the importance of oral language to the development of reading skills (Sticht and James, 1981). All three positions share the fundamental understandings that, typically:

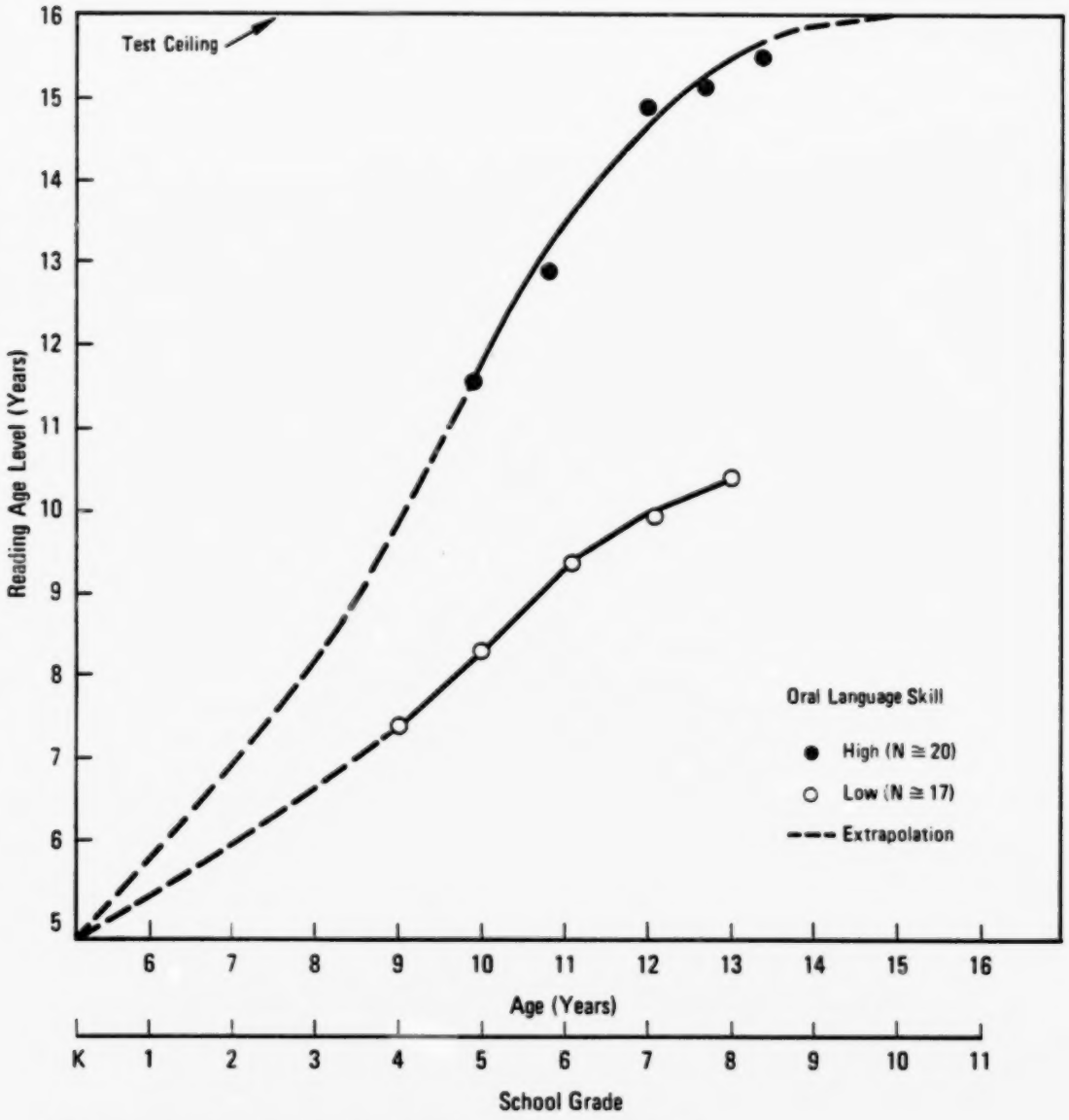
(1) Oral language skills develop to a fairly high level before the development of written language skills.

(2) Oral and written languages share much of the same lexicon (vocabulary) and syntax.

(3) Beginning readers draw upon their knowledge of oral language in learning to read.

Loban's (1964) longitudinal studies present the clearest picture of the relationships of early skill in oral language to later skill in reading. Loban measured preschool children's oracy (listening, speaking) skills and identified two groups, those high in oracy skills and those low in such skills. He tracked them in the school system and measured their reading skills beginning in the fourth grade. As shown in Figure 3, students low in oral language skills before the first grade turned out to be the poor readers in the fourth grade and onward through the eighth grade, and the gap between good and poor oral language users on the performance of written language tasks grew wider over the school years.

Other data reviewed by Sticht et al. (1974) clearly show that the development of written language skills is greatly facilitated by the development of high levels of oral language skills. In fact, for many purposes, learning to read may be viewed as learning to be as efficient in performing tasks involving written language as one is in performing tasks involving spoken language. The review by Sticht et al. indicates that, when children first enter school, they can comprehend spoken messages and remember the information much better than they can if the same messages are presented in the written language for reading. By about the 6th to 8th grades, however, people are likely to do as well by



NOTE: Figure constructed from data given in Loban, 1964, page 117, Table 16.

Figure 3. **Relationship Between Chronological Age/School Grade Level and Median Reading Ability for Students Rated High or Low in Oral Language Skills in Kindergarten**

reading as they can by listening, indicating that they have closed the gap between comprehending by ear and by eye.

Because learning to read includes learning to comprehend by reading as well as one can by listening, it follows that if children could learn to comprehend better by listening to spoken language, then when the reading skill is developed to the point of

parity between ear and eye, the child would be reading on a higher level. In this case, the child's ability to comprehend the spoken language can be regarded as an indicator of the potential for that child's reading achievement if he or she could instantly be given the power to decode and comprehend the written language.

Youth and Adult Literacy Development

By now, the direction I am heading will have become apparent. If the child's preschool language development is strongly dependent upon the parent's literacy and oracy skills, and if the child's literacy skill development in school is largely dependent on the child's oracy skills developed prior to schooling, then a major approach to improving children's literacy skills is to improve their parents' language skills, both oral and written.

In this way of thinking, youth and adult literacy development should be a high-priority program for education policymakers not only because so many adults are living in marginal circumstances and have only marginal literacy skills to cope with our high-information density culture, but also because the parents' educational achievement can be transferred to their children. In other words, to complement our intervention programs that give funds to the schools to mediate between the society at large and the children from marginally literate homes to improve those children's basic literacy skills, we can imagine a program in which children's literacy skills are mediated before the school days through extended opportunities for educational development of adults/parents.

I have underlined the word extended to draw attention to the fact that in proposing adult education as a major method of improving children's educational achievement, I do not refer to the typical current adult (youth) basic education programs. Such programs are totally inadequate to improve adult competencies enough to offer much by way of transfer to the children, or, for that matter, to do much for the future life of the adults who participate in them (cf., the chapters on adult literacy training in the volume edited by Carroll and Chall, 1975). Most adult basic education programs attract and hold adult clients for only about 50 to 100 hours of literacy development. They typically make only about one to two grade-levels of improvement in that period of time, and even that much gain is suspect in terms of subsequent retention of skill. For the six percent or so of the high school graduates who leave high school reading below the seventh grade level (Fisher, 1978, p. 37), a year's gain hardly suffices to make a difference in living style or in manner of speaking and interacting with one's children at the oral language level.

What is needed is a commitment to pursue, with as much vigor and funding as in the current school-based intervention programs for children, a program of adult literacy development that regards such development as a perfectly appropriate activity for a nation. In such an approach, the development (not remediation!) of adult capabilities would be considered as important a task as children's development.

PART III:
HUMAN RESOURCE DEVELOPMENT FOR EDUCATION AND WORK

Though long-term development of adults is necessary to break the cycle of marginal literacy and marginal living, there is reluctance to make a commitment to such development. This appears to reflect economic conceptions of human resources development that place a cost/benefit utility on education. From a labor economist's perspective, the 12 years of public schooling are allocated to the development of people, who are then available to be used as the work force. In this approach, schools develop people, and employers utilize people. If, for instance, a person does not acquire fifth grade reading skills in the fifth grade, then, as an adult, the person is not to be developed but "remediated." The latter should be done as quickly as possible so the person can be utilized productively.

The problem, as pointed out earlier, is that many adults need a long-term period of development. However, they also need to be productively employed while they are developing. We need research to discover means to enable employers to both develop and utilize persons whose basic skills may be below the standards usually expected. Additionally, we need to find ways for organizations of various types (e.g., correctional institutions, government agencies, two- and four-year colleges) to adapt to and develop less capable adults in a cost-effective manner.

The second objective is important because we do exist in a real world of limited resources, with priorities that emphasize gaining the most benefit for the least cost. To expect employers and organizations to expend resources to develop basic skills of adults (a job they often resent because "that is the school's job"), we must find ways to help organizations of many types become more effective in performing the many functions that contribute to the health of the organization.

Organizations such as the military, government agencies, large industries, and businesses have a variety of functions that relate to human resources. They have to recruit new workers, select them, assign (classify) them to jobs, (possibly) train them in job-technical training programs, assess and evaluate performance on the job, make selections for promotions, and provide for dismissal or retirement or other termination of employment.

If the organization recruits in a scarce work force, such as the 18- to 24-year-old population will be in the mid-90s (Canter, 1978), then activities that will improve recruitment, by enlarging the eligible work force, will contribute to the health of the organization. If the size of the eligible work force is being restricted by the presence of persons whose basic skills are below the organization's entry standards, then the discovery of cost-effective approaches for developing people's basic skills within the organization would enlarge the eligible work force, thus increasing recruiting effectiveness and productivity.

A well-conceived and executed human resources development system within an organization provides a method for developing the literacy and learning skills of marginally literate youth and adults while they are productively employed. It also enables the organization to do its work more effectively. To bring about such a

system we must, on the one hand, consider the nature of literacy and learning and how such skills are developed. On the other hand, we must ask how an organization can utilize people effectively at their present developmental level, and then what must be done to further develop people's basic skills.

When one focuses not on improving individuals but on improving organizations, one develops perspectives that are different than in considering human resources development as general education. In organizations that deal primarily with the utilization of human resources, such as any number of businesses or industries, the Department of Defense, or other government agencies, human resources development does not have as its goal the improving of the individual's skill and capability, per se. Rather, the purpose is to improve organizational effectiveness in performing its functions. The improvement of individual capability is undertaken as a means to organizational ends, not as an end in itself.

Organization and Education Perspectives on Education

The organizational effectiveness perspective differs from the general education perspective of the schools. Organizational concerns are superordinate to individual concerns. The organization intends to exist, and in order to exist it must accomplish its mission. There is concern for improving individual capability to perform specific kinds of tasks. This viewpoint is contrasted with the educational approach, which has as its goal the increasing of people's potential in some rather abstract sense.

In an organizational setting such as the work place, the intention is to do something very specific. The general education system, on the other hand, operates under the constraint of not knowing precisely what students may end up doing out of school. It has to prepare them in some way to cope with a host of potentialities, and, as a consequence, it will overeducate people considerably with respect to some specific situation. That is a necessary precondition to making satisfactory performance possible in a number of situations later on. If one does not know the nature of the world to be encountered in the future, taking a broad scope approach to education prepares students for the greatest number of contingencies. That is one of the reasons why we take up to 12 years to develop a broad range of competences in students; we do not know what they may encounter, and so we try to prepare them for anything and everything.

Employers can employ certain tactics to improve their organizational effectiveness that are not available to our public schools, at least under present laws and regulations. For instance, employers can improve their companies' effectiveness by screening out people; they do not have to hire everybody. However, the screening-out strategy for improving personnel skills is effective only so long as the work force presents sufficient numbers of people to permit such exclusivity. When the work force shrinks, when the social circumstances are such that organizations have to draw upon the population whose talents are below the level thought necessary, then one has to begin a process of organizational development to devise methods to meet this new challenge.

Another tactic an organization can take to accommodate less capable persons is to assign those people to low-level, perhaps dead-end, jobs. While the people involved may have a problem, the selective assignment of people to less desirable positions may be a workable strategy in organizational settings.

Many organizations have training programs and use written materials on the job. In many cases, it is completely within the organization's capability to redesign the training program, or to redesign the job materials, so that they are able to train and utilize people at the low level of skill with which they enter the job, without investing in further development of employees.

Another approach is to initiate policies that place hurdles before less literate workers. A policy might require an employee who has been on the job for a certain number of years to obtain at least an associate of arts degree from an accredited community college for further promotions. This tactic raises a credential barrier that has the effect of making the person go through a certain set of processes to attain that goal.

In contrast to the foregoing tactics, the research that we at HumRRO have been pursuing has as its general goal the development of methods to let organizations both effectively utilize people and develop their capabilities after bringing them into the job setting.

This leads to such tactics as screening-in people, diagnosing where they are in terms of skills development, and then building their capabilities beyond that. It leads to the redesign of training so that one can simultaneously promote the learning of basic skills and job-technical skills. It leads to the design of human resources development systems that include counseling, education, and training components. These are all articulated at the policy level and with regard to the content and scope of the training and educational activities, so that the organization can provide a program of continuous development extensive enough to overcome long-term literacy and learning problems.

One reason we have taken this approach is that our work in the Department of Defense over the last decade or so has shown that it is very difficult to teach adults whose basic skills are not well developed. Further, it is unreasonable to expect adults who are reading at a third- or fourth-grade level to actually achieve five or more "years" of growth in reading grade levels in a six-week or 100- or 200-hour program, which is typical of the time generally allowed for basic skills "remediation" in government or industry programs (Sticht, 1982).

The use of very brief programs of literacy training follows from the concepts of human resources development and utilization mentioned previously. If people are not developed to a certain level when they come to the organization, then they cannot be utilized. In this case, the company may initiate a literacy program. However, this adds to training costs and detracts from productivity. Therefore, managers seek to reduce time spent in training, and any basic skills training program stands out as the first place for a budget cut. When times get a little better and organizations can screen less literate people out again, that is what they tend to do.

The goal of our research has been to help make it possible for organizations to both utilize and develop people. This has included attempts to find ways to reduce the discrepancies between people's entering skill levels and the demands of jobs by such activities as redesigning materials to make them easier to use in the early stages. In this case our reasoning goes like this: If an organization recruits people whose capabilities are very low, one can redesign materials to permit these people to perform a useful, productive job upon entry into work, while at the same time one can provide a developmental program that integrates job-technical and basic skills training, so that the employees' actual and potential utility to the organization can be devoted.

Redesigning job materials to give less literate people access to productive work makes it unnecessary to screen them out. From the organizational point of view, this improves recruitment by expanding the size of the work force available. This approach gives people access to jobs and an opportunity to work, plus access to a developmental system that permits them not only to perform an entry level job, but to develop the basic literacy and learning skills needed to proceed to a higher level job.

PART IV:
USES OF LITERACY IN JOB SETTINGS

Research toward the development of a human resources system that permits developing as well as utilizing personnel, and that is cost-effective for the organization, has been performed by the Human Resources Research Organization (HumRRO) in a program of research projects that spans the last decade and a half. Much of this research has been conducted within the framework of the developmental model of literacy outlined earlier.

In this section aspects of this research will be described. The first project discussed relates to the idea that reading may serve as a substitute for auding (listening). This research focused on the auding and reading practices of good and poor readers working in three jobs and sought to find out whether poor readers use auding more than reading to gain information, and whether good readers use reading more than auding to obtain needed job information.

The second research project discussed focuses on the performance of job reading tasks that rely upon the unique properties of printed displays, that is, their permanence, spatiality, and use of light. Other projects discussed deal with functional contexts for reading, analysis of reading tasks, and the development and evaluation of job-related literacy training programs.

Auding and Reading on the Job

Research was conducted to see whether personnel in three Army jobs tend to use reading as a supplement to auding, and whether this tendency changes as a function of reading ability. This topic is related to the aspect of the developmental model which holds that reading may serve as a second signaling system for auding. In this case our interest was in finding out whether less literate personnel "get by" on the job by using their oral language skills in circumstances where more literate personnel use written language skills.

In this research (Sticht, 1975a) interviews were conducted with men working in the Army as Cooks, Repairmen (automobile mechanics), and Supply Specialists. The personnel interviewed had reading skills, stated in reading grade level equivalents, of either grades 4-6.9, 7-8.9, or 9 or greater.

The men were interviewed at their job sites, and were asked to give five instances when, in the last month or so, they had been performing a job task and had had to ask someone for information about the task. Since the people who were asked replied by speaking, the person received the information by auding. Thus we obtained up to five examples of the use of auding by personnel of three levels of reading ability.

A similar procedure was followed to obtain information about the use of reading. Personnel were asked for five instances from the last month or so when they had been doing some job task and had had to read something to complete the task.

The results of the interviews are shown in Figure 4. There we have plotted the average percent of maximum citations given for each reading level group in each job.

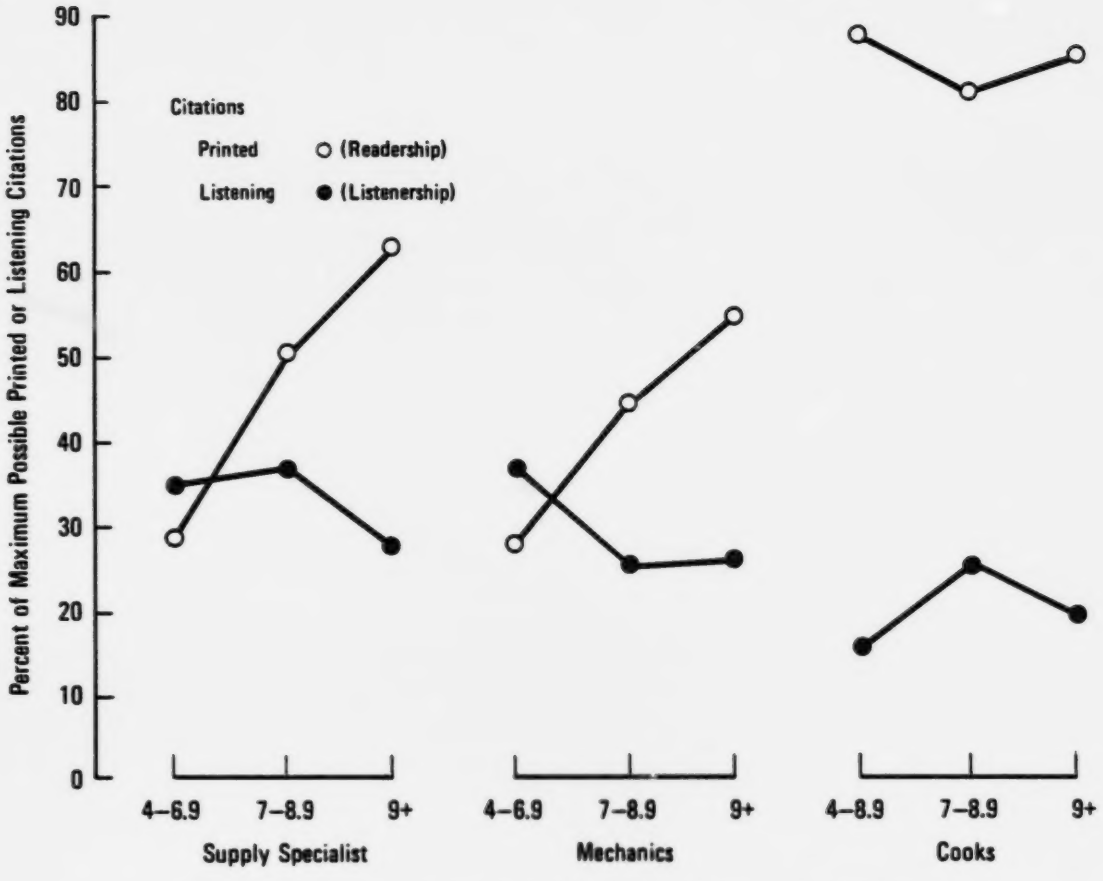


Figure 4. **Citation of Reading and Listening Information Sources by Reading Ability Level**

Since we asked for five citations of auding and reading, a score of 20% means that, on the average, only one citation was obtained. A score of 40% means that two citations were given, and so forth.

For the Supply Specialists and Repairmen, statistical analyses and the data of Figure 4 show a clear relationship between reading ability and the reported use of auding and reading skills—the more able the reader, the more likely he was to use the printed medium. For Supply Specialists, readers in the grades 4-6.9 reading groups gave only 30 percent of the maximum possible citations of use of reading, contrasted with nearly 65 percent of the maximum possible citations for the group of readers in the grades 9+ range. For Repairmen, the use of reading increased from 30 percent to 50 percent of maximum as a function of reading ability, while the data for the Cooks show a uniformily high citation of reading. As it turns out, the cooks use simple recipe cards daily, and hence were able to provide practically the full number of citations of reading requested.

Regarding the use of print as a second signaling system for speech, among Repairmen and Supply Specialists poor readers tend to use auding and reading to about the

same extent, although auding is slightly favored. With greater reading skill, the use of reading tends to increase, while the use of auding decreases slightly (though with the small groups studied here, the decline in auding citations is not statistically significant). Notably, too, the poorest readers do not make up for their low usage of reading by an increased use of auding. Rather, they simply operate with an overall lower level of seeking job-relevant information.

These data suggest that one consequence of developing skill in reading is that people can, and often will, use this capability to obtain information in addition to what they get by auding. Additional research with different personnel in the Supply Specialist and Repairman's jobs indicated that if these personnel used job manuals while performing job sample tests, they performed more accurately than if they did not use manuals (Sticht, 1975a, p. 54). If, by vocational competence, we mean the ability to perform job tasks with high degrees of accuracy, these findings suggest that acquiring reading skill may augment the seeking of job information from printed sources, and that this propensity may pay dividends in improved job performance.

The Nature of Job Reading Tasks

Our analysis of written language has indicated that it differs from spoken language in three major features: Written language is more or less permanent, it can be arrayed in visual space, and it utilizes properties of light, that is, brightness contrast and color. These features make possible the use of written materials for reference purposes, so that information does not have to be learned. Persons in non-school settings appear to use printed materials in such a "consultative" fashion to a much greater extent than they do as material to be learned. Furthermore, when printed materials are used for learning purposes, the features of permanence and spatiality are drawn upon in various study strategies, such as preview/review (based on permanence) and outlining and underlining (based on the use of visual space and contrast).

In general, the features of permanence and spatiality permit two broad classes of reading tasks. In the first class of tasks, information is looked up in order to do some task at hand, and may then be forgotten. This I call a reading-to-do reading task. The printed language serves as an external "memory" that can be consulted. Because the information is stored in the book, it does not have to be "stored in the head"; it can simply be looked up if needed again.

The second general class of reading tasks is reading-to-learn. Because the written language is permanent, it can be studied and the information can be learned for later use. Many study strategies may make use of the properties of visual space to enhance learning.

Information on the performance of reading-to-do and reading-to-learn tasks in job settings was obtained in interviews with some 180 Navy personnel in ten job fields and for three job roles: students, instructors, and active job performers (Sticht et al., 1976). Personnel were interviewed at their school or job duty sites. An attempt was made to get one citation of a reading-to-do and one of a reading-to-learn task from each person interviewed. Thus, for students, instructors, and job incumbents we sought 50% reading-to-do and 50% reading-to-learn tasks.

However, as Figure 5 shows, with increasing distance from the technical school setting, the proportion of reading-to-learn tasks which people reported performing in the last 24 hours decreased, and the proportion of reading-to-do tasks increased such that some three-fourths of the tasks obtained from job incumbents were reading-to-do tasks. Mikulecky (1981) found similar results in studying differences between high

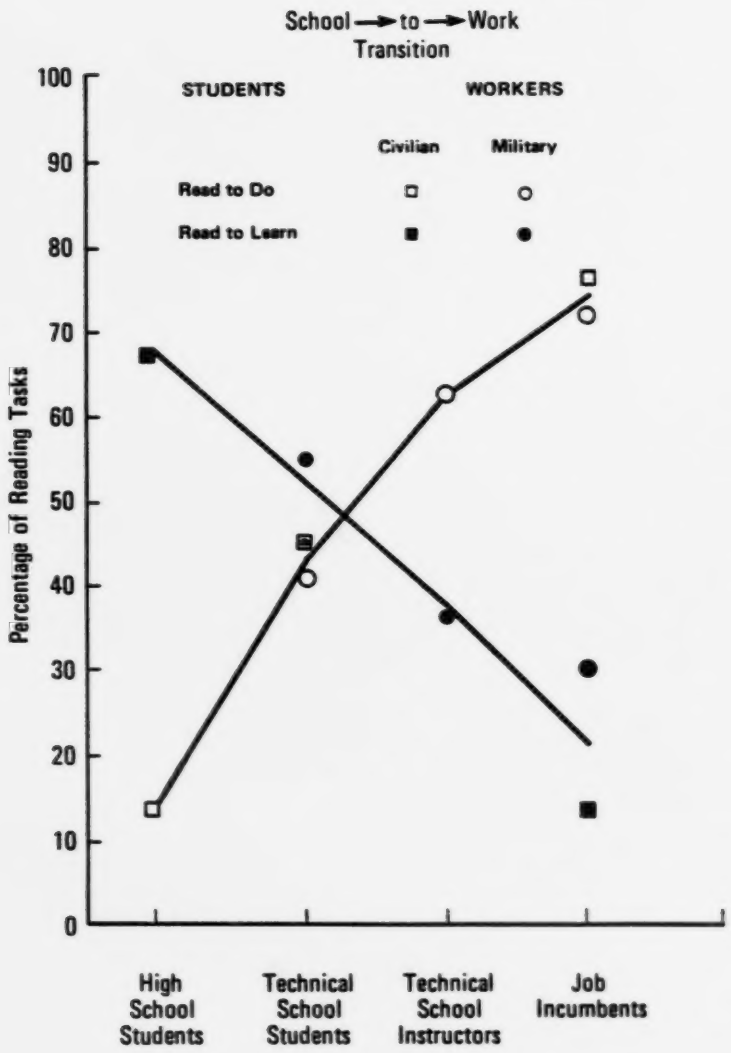


Figure 5. **Changes in the Primary Literacy Tasks in the School to Work Transition**

school students, technical school students, and job incumbents in civilian settings. Figure 5 presents data from Mikulecky's work categorized as in the Navy work. He reported that 66% of high school reading tasks were reading-to-learn tasks, while only 15% were reading-to-do tasks. Technical school students in civilian programs, like those in the military schools, showed an almost equal amount of reading-to-learn and reading-to-do, while civilian job incumbents in professional, clerical, and blue collar jobs reported 78% reading-to-do and 15% reading-to-learn tasks. Thus, the civilian and military data are quite consistent and mutually confirmatory in indicating that the school-to-work transition reverses the primary uses of literacy skills.

The fact that students in high school and in technical training perform proportionately more reading-to-learn tasks is consistent with their role as students. In confirming what we would expect of students, the findings also suggest that, in many trades and skilled jobs, the cognitive demands of job training are likely to exceed those of job performing. While reading is common to both classes of tasks, reading-to-learn makes additional demands on information processing strategies for learning from textual materials.

A framework summarizing several additional categories of information obtained during the Navy interviews is presented in Figure 6. As indicated in the left half of the figure, in soliciting information about job tasks and job reading tasks we attempted to find out something about the knowledge contexts supporting these activities. For instance, do job tasks which involve reading subtasks tend to be relatively unfamiliar tasks? Or are they repetitive in nature? Has the person performed similar job tasks? For reading tasks, we want to know whether this is the first time the person has read the material. Or do workers tend to read repetitiously, or in areas related to the reported reading task?

Answers to such questions reveal the extent to which job contextual or personal/tacit knowledge, as discussed in the developmental model of literacy, may facilitate reading comprehension. They also suggest the extent to which the reading skill is called upon to forge into new areas, to subdue "cognitive brushfires" in a variety of content domains. Jobs requiring such flexible use of reading skills may require more broadly developed bases of knowledge and more flexible reading strategies than those in which reading is repetitive or mainly in related areas.

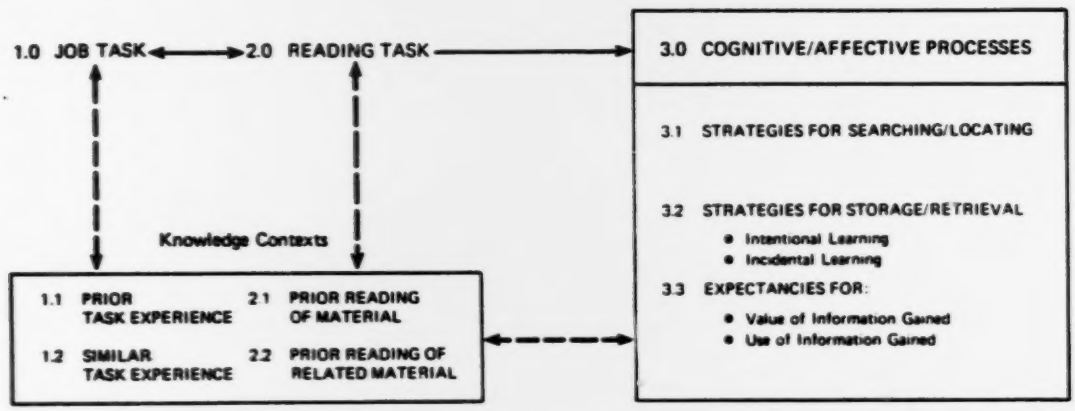


Figure 6. **Major Categories of Information Obtained From Job Personnel Regarding Previous Experience With Job Tasks and Job Reading Tasks, and Some Cognitive/Affective Factors Involved in Processing Information From Reading Materials**

In the right half of Figure 6 are the categories of information sought regarding cognitive/affective processes involved in the use of reading on the job. The cognitive/affective processes focus upon one of three major types of activities:

(1) Those expected to be of primary importance for reading-to-do tasks, in which searching for and locating information plays a major role.

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(2) Those expected to be of primary importance in reading-to-learn tasks; that is, strategies for storing information in a retrievable manner.

(3) Those which create implicit expectations for the value of the reading task (What are the consequences of a reading error?) or for the use of the information learned (Will it be used? When? How often?).

Detailed data for each of these categories of information can be found in the report by Sticht et al. (1976). Only summary statements will be given here.

The data regarding the knowledge contexts for job tasks and job reading tasks indicated that, for the most part, job-related reading is used in conjunction with tasks that are repetitious and are similar to other job tasks. Many of the reading tasks themselves are likely to be performed in a cyclical manner, such as daily or weekly. Mikulecky's (1981) work confirms these findings in a number of civilian jobs.

It is perhaps because of the repetitive, homogeneous nature of job tasks and job reading tasks that the effects of lower levels of literacy, and, conversely, the relatively high levels of reading difficulty of materials in military and civilian jobs (Sticht and Zapf, 1976; Mikulecky, 1981) can be tolerated. Personnel have repeated opportunities for gaining experience in performing job tasks, including the reading and rereading of materials used in support of the job task.

Efficiency of reading may improve due to repeated reading of a homogeneous set of materials concerned with a restricted body of knowledge. This possibility is suggested by the information obtained on the cognitive processes for searching and locating information, which indicated that tables of contents and indexes were used for only about 25% of the tasks for which they were applicable. This was determined by asking personnel to obtain the materials used in performing reading tasks and to show the interviewer the exact material which had been read. The interviewer noted whether the person used the table of contents or the index, or simply "flipped through" materials to locate the information; the latter strategy accounted for three-fourths of search/locate tasks. In part, this reflects the repetitive nature of job reading.

Information bearing on the strategies personnel use for storage/retrieval of what they read was obtained for reading-to-do and reading-to-learn tasks separately.

For the reading-to-do tasks, we tried to find out whether the information looked up while performing a job task was likely to have been learned. We also sought to find out whether information that had been learned during the performance of the reading task had been intentionally learned, using some strategy for learning, or had been incidentally learned simply by reading and doing the job task.

Personnel were asked: "If you were doing this job task again tomorrow, would you read this material again tomorrow?" For three-fourths of the tasks the answer was "yes". In part, this represents a large number of tasks in which reading is an inherent part of the task: filing a document, filling out a form, computing an index number from tabular data, and so forth.

One-fourth of the reading-to-do tasks were reported as requiring no rereading the next day because the information had been learned. Some 70% of this information was reported as having been learned just by reading the job materials and doing the job task. This we called incidental learning. In such learning, most people could not recall any particular learning strategy; the information processing involved in extracting information from texts and/or applying it evidently provided enough cognitive transformation for learning to occur. Whatever processes might be involved in this type of incidental learning during reading-to-do task performance, it is not the method of choice when the task is reading-to-learn.

Three-fourths of the reading-to-learn tasks were reported as having involved special study techniques, while only one-fourth of these tasks were reported as having been learned simply by reading, as in the reading-to-do tasks. Table 1 summarizes the answers to questions asked to determine the nature of the learning strategies people reported using in performing reading-to-learn tasks. The 147 open-ended responses were grouped under four categories of learning strategies:

- Reread/Rehearse (R/R): Involves repeating the processing of information taken from text, with minimal elaboration or transformation.
- Problem Solve/Question (P/Q): Involves answering text questions; solving problems in texts; activities which stimulate a search through materials for obtaining specific answers.

Table 1

Learning Strategies Used in Reading to Learn Tasks

Reread/Rehearse (R/R)	No. Responses	Relate/Associate (R/A)	No. Responses
Reread/repeat	34	Use pictures/diagrams & relate to test	15
Memorize by repetition	7	Discuss with someone	4
Preview/then read	4	Associate to other information	3
Copy verbatim in writing	2	Listen to lecture	3
Record on tape, listen to tape	1	Use mnemonic device	2
Teach to someone	1	Make drawings	2
No. of Responses	49	Use other reference materials	1
		Watch demonstration	1
Percent of Total	34%	Relate notes and book	1
		Relate to previous work	1
		No. of Responses	33
		Percent of Total	23%

Problem Solve/Questions (P/Q)	No. Responses	Focus Attention (F/A)	No. Responses
Practice problems	21	Take notes/study	12
Check problems against book	8	Pick out key points	3
Take test/answer questions	7	Use outline	1
Review questions/answers in test	6	Underline	1
Use study guides	1	Use study schedule	1
No. of Responses	43	No. of Responses	18
Percent of Total	30%	Percent of Total	13%

TOTAL NUMBER OF RESPONSES: 143

- Relate/Associate (R/A): Involves use of mnemonics; discussion of material; associations of new information with other information; elaborations.
- Focus Attention (F/A): Involves activities which in some manner reduce the amount of information to be reread; e.g., underlining key points, outlining, taking notes.

The most frequently reported strategy was to reread the material. This accounted for almost 25 percent of the total responses. Strategies which focus attention by reducing the information to be reread or studied were the least frequently reported, accounting for only 13 percent of the total. The relate/associate strategy category received the greatest number of different entries, though some may disagree with the present sorting. For instance, is "discuss with someone" an R/A or R/R strategy? Here it was sorted into the R/A category simply because it was imagined that such discussion would add elaborative encodings to the information. No doubt, all R/A includes some R/R—nor can any of these categories be considered as mutually exclusive of all the other types of strategies. The category label is meant to reflect a judged relative weight for the type of strategy named.

These open-ended responses reveal a wide range of specific learning techniques, many of which have never formed the basis for research on learning in the psychologists' laboratory. The findings suggest that much "text learning" involves additional information sources such as diagrams, movies, tape recorders, and even other people with whom materials may be discussed. The study of ecologically valid learning strategies is needed if we are to fully understand what kinds of competencies people draw on to accomplish learning goals.

Functional Contexts for Reading

As mentioned earlier, we wished to better understand the general cognitive/affective processes involved in performing work-related reading tasks. One such area of interest that is poorly defined is the expectancies people have as to why they are doing what they are doing, what its value is, and how they will use what they are learning. The expectancies are frequently implicit, and are made explicit only on inquiry. Several indirect indicators of expectancies were incorporated into the survey of work-related reading.

Estimates of the perceived value of reading were obtained by asking people what they thought would happen if they made a mistake in doing their job because they made a reading error while reading-to-do or reading-to-learn. Would it affect only them? Or would there be some direct effect to the Navy system—a cost in time, material, and so forth? Our notion here was to find out if people perceive a link between their reading behavior and some possible consequence for the job.

The results for 443 responses indicated that in 29 percent of the responses, personnel felt that a reading error would affect only themselves. Generally this would mean some type of verbal reprimand. The major consequence for the Navy would be loss in time (24%), with loss of time plus materials being the next most frequent consequence of a reading error (15%).

For the most part, then, Navy personnel see some consequence, and thus, we would say, some value for their reading. There are perceived contingencies between the act of reading and the functioning of the Navy as an operational system. Reading thus has a perceived functional value.

Expectancies for the use of information gained from reading were obtained for the reading-to-learn tasks. A direct question was asked: What is your reason for reading-to-learn the job information? For 115 reading-to-learn tasks, 47 percent were reported as having been performed to prepare for a test or because it was required. This result was mainly due to responses by students and job incumbents, many of whom must take correspondence courses and pass final course exams to got promoted. About 80 percent of the instructors' responses were that they read in order to teach the material. Thus, as in public schools, reading-to-learn tasks are motivated in large part by system requirements for testing or certification to qualify for advancement to some next level of responsibility at work or grade level in school.

Additional insight into the perceived uses of what was learned in reading for learning tasks was obtained by asking respondents: How long do you have to remember the information before you first use it? And: How often do you expect to use the information that you learned?

Results indicated that more than half of the reading-to-learn tasks provided information which personnel expected to use within 24 hours, while 90% of reading-derived information was expected to be used within 30 days. Over half of the tasks provided information which personnel estimated they would be using daily, and 75% provided information that they expected to use every month.

Generally then, these findings suggest that the reading-to-learn tasks were perceived as being performed for a definite purpose, that the information learned would be used relatively soon and would be used repeatedly, and that reading errors could lead to serious consequences both for the person and for the Navy as an organization. These expectancies provide a functional context in which reading is an instrumental act for acquiring information which will be used. (Or so it was expected; it is notable that reading-to-learn was reported more by entry-level students than anyone else, and that experienced job performers estimated that one-fourth to one-half of what they had learned in job training was irrelevant to their jobs! This may reflect true mismatches between the technical training courses and the tasks performed on the job, or it may reflect the same type of need for overtraining in technical schools that the public schools face. In the military, as in the public schools, there is not absolute certainty of just what tasks in what contexts must be performed at different job locations around the world. Training courses train for some model of the job that does not represent the job at any given place or time.)

The motivating force of functional contexts can be used in designing vocational reading programs to provide basic skills training to students whose academic preparedness is inadequate. When vocational literacy training incorporates job-related reading tasks, students may perceive a functional use for literacy and will frequently be motivated to learn to read when traditional, "general" literacy programs fail to engage them (cf., Sticht, 1975b, for an example of a job-related reading program; Diehl & Mikulecky, 1980 have replicated many of these findings in an analysis of some 100 civilian occupations).

Analysis of Reading-to-Do Tasks

While the importance of reading in both job training programs and job performance is clearly shown, the identification of reading-to-learn and reading-to-do tasks provides a rough indication that, in many cases, job training programs may make considerably more demands than the jobs themselves on literacy skills. The training involves the

complex strategies used in studying to transform the store of information in textbooks into a store of knowledge in memory that can later be used to complete course examinations.

However, reading demands of jobs must be determined more precisely if we aim to use such information in establishing objectives and curricula for education to provide students with the literacy skill levels needed to perform reading tasks in the world of work—that is, to render students vocationally literate. In this case, what we would like to know is: What are the reading tasks people have to perform in various jobs, and what level of skill is needed to perform those tasks?

In research conducted for the Navy, we attempted to develop an inventory tool that job analysts could use to (1) identify the reading tasks people perform in various jobs, (2) determine the percentage of people reading at different skill levels (expressed in reading grade levels as determined by a standardized reading test) who could be expected to accurately perform the job reading tasks, and (3) estimate the level of reading skill needed to achieve management goals for job proficiency and performance (Sticht et al., 1976). The report presents a detailed discussion of the methodology and a critique of several different methods for estimating the reading requirements of jobs. Here I will briefly summarize the outcomes of our efforts.

In defining job-related reading tasks in this exploratory work, no attempt was made to consider reading-to-learn tasks. Attention was restricted to the reading-to-do tasks identified in the interviews described above. For purposes of developing the Navy Reading Task Inventory, we grouped the ten jobs into three clusters, as shown in Figure 7

The next step was to identify (1) the type of information sought in performing each task, and (2) the type of display in the reading materials. Type of display was classified as text (which would be written language); figures (including line drawings, photographs, and schematic diagrams); tables (including both numerical and verbal tabulations); text plus figures; text plus tables; or tables plus figures.

Analysis of interviews revealed that the information sought was usually some type of factual data; the person was trying to find out how to do something. Thus, two categories of reading skills—fact finding and following directions—were identified (see Figure 7).

Analysis of the reading-to-do tasks for students, instructors, and job performers, summed over the three vocational clusters, showed that 110 required fact-finding skills and 76 required following-directions skills. Instructors and job incumbents utilized fact-finding skills two to four times more than following-directions skills, whereas students used following-directions skills twice as often as fact-finding skills (though this differed in the data-oriented jobs).

Analysis of materials by display types revealed that the combination of tables plus figures occurred rarely, so this type of display was not used in the subsequent research. Texts constituted the most frequently used type of display and made up about one-third of the display types, with figures running a close second, at somewhat less than 30 percent of the display types. Tables, text plus figures, and text plus tables occurred in that order of frequency, behind texts and figures.

This analysis indicates that, while reading as a substitute for auding (which would be represented by text alone) occurs in jobs, such tasks do not always predominate. Figures and tables, both displays that draw upon the features of permanence and spatial layout, which are unique to the written language, form a significant part of job-related reading. Jobs differed in the relative frequency of use of displays; technical maintenance jobs used proportionately more figures, and data-oriented jobs used figures and tables to about the same extent.

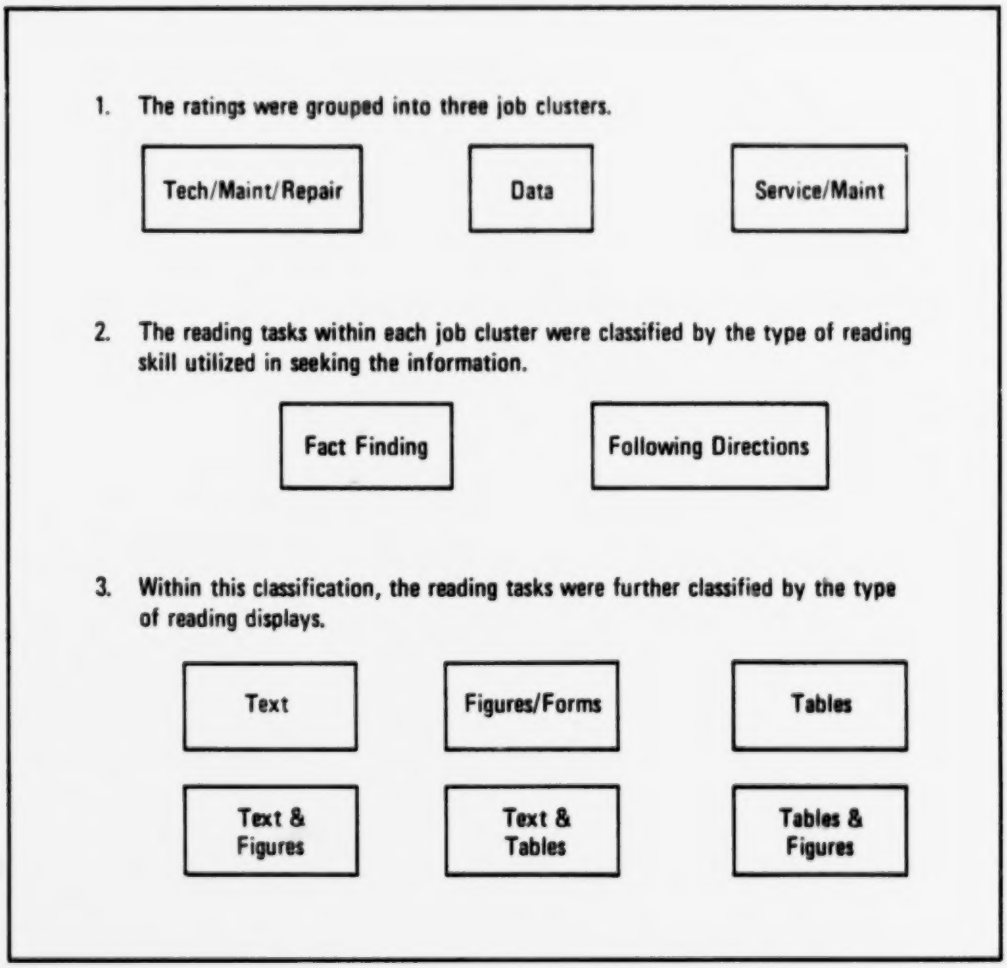

1. The ratings were grouped into three job clusters.
Tech/Maint/Repair
Data
Service/Maint
2. The reading tasks within each job cluster were classified by the type of reading skill utilized in seeking the information.
Fact Finding
Following Directions
3. Within this classification, the reading tasks were further classified by the type of reading displays.
Text
Figures/Forms
Tables
Text & Figures
Text & Tables
Tables & Figures

Figure 7. **Analysis of Job Reading Tasks**

The Reading Task Inventory

By means of the classification system outlined above and presented in Figure 7, we defined generic reading tasks as the application of either fact-finding or following-directions skills to texts, figures, tables, text plus figures, or text plus tables. Tasks composed of the two skills applied to the five display types were found in all ten of the jobs making up the three career clusters of Figure 7. They therefore represent, at an abstract level, the types of reading tasks which Navy personnel perform in the course of doing a job. In an abstract manner, this analysis answers the question: What are the reading tasks people have to perform in various jobs in the Navy? The answer is: They look up facts in texts, they look up directions in texts, they look up facts in figures, they look up directions in figures, and so forth.

Conceivably, we could develop an inventory simply by asking people whether they look up facts in texts, figures, tables, and so forth. In work for the Department of Manpower and Immigration in Saskatchewan, Smith (1975) and associates used a somewhat similar inventory approach in which they tried to identify both the kinds of materials (such as notes, memos, letters, directions, instructions, policy manuals, and the like) that were read in a number of occupations and the reading tasks that were performed in those jobs (e.g., read to locate facts, to follow directions, or to discover the main idea). To obtain this information, interviewers displayed the general type of material they were talking about. For instance, in determining whether a given job required the reading of graphs, they showed two graphs as examplars and asked interviewees whether they read similar graphs in performing their jobs. A problem with this approach (in which people simply indicate whether they read some type of material) is that it does not distinguish among complexities of materials, and it does not indicate the level of reading skill required to perform the set of reading tasks in a given occupation.

To overcome these difficulties in the Navy research, we constructed a reading-task inventory that included three levels of complexity for each type of display. The displays were taken from the Navy's Bluejacket's Manual, the 617-page basic manual for Navy recruits. This manual is meant to be read using only general reading skills and knowledge, and its content is familiar to all Navy personnel. These features are important, because a primary type of information desired for the analysis of occupational reading requirements is "data on the level of reading skills required to have access to the occupations." (Miller, 1973). Since the Bluejacket's Manual is an entry-level manual it represents the type of material that one must be able to read to have access to all Navy job training and occupational fields.

To develop an inventory that we could use to identify the kinds of reading tasks recruits perform, and to discover the general level of reading skill needed to perform those reading tasks, we searched the Bluejacket's Manual to locate three specific instances of each of the five abstract categories of generic reading tasks identified in Figure 7. Having three examples of each generic reading task permitted us to distinguish three levels of complexity for each reading task. These levels were confirmed by two judges.

The types of displays included in the inventory are shown in Figure 8. On the left-hand side is a sample of text plus table material from the Bluejacket's Manual. On the right-hand side are the inventory questions. This particular page from the inventory is for fact finding, so job incumbents were asked whether, in their jobs, they ever had to perform reading tasks using material like this to look up facts. If they said yes, they were asked questions about the frequency of performance, and then questions about the consequences of making a reading error. These data are used to make decisions about the criticalness of a reading task.

To identify the general level of literacy required to perform each reading task, we wrote fact-finding and following-directions questions for each of the display types in the inventory. The resulting job-related reading tests were administered to some 250 Navy personnel, along with a standardized reading test. With these two sets of data, we could then determine how well young adults of different reading skills could perform on the job-related, reading-task test items.

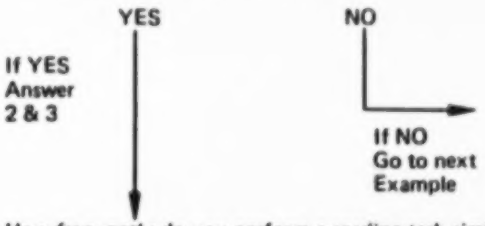
Figure 9 shows the results of asking a following-directions question using the same material that was shown in Figure 8 as a fact-finding inventory item. This type of display shows the job-related reading material on the left side of the page, and on the right side of the page presents the type of reading task, its form (in this case E for easy), and the questions.

All ships are assigned *designations*—a group of letters which indicate their type and general use—and *hull numbers*, which are usually assigned in sequence to ships of a type as they are built. These identifying designations are used in correspondence, records, plans, communications, and sometimes on ship's boats, because letter and number designations are shorter than the ship's name—*Mission Capistrano*, (AC 162)—and help to avoid confusion between such similar names as *Home* (DLG 30) and *Hornet* (CVS 12) or *Phoebe* (MSC 199) and *Phoebus* (YF 294).

The first letter in a designator is a general classification: *D* for destroyers, *S* for submarines, *L* for amphibious vessels, *M* for minewarfare vessels, *A* for auxiliaries, *W* for Coast Guard vessels, *T* for Military Sealift Command ships, and *Y* for service and yard craft. In combatant designations, the letter *N* means nuclear powered and *G* means the ship is equipped to fire guided missiles. A listing of most ship designations follows; minor yard craft and service craft have been omitted.

AD	Destroyer Tender
ADG	Degaussing Ship
AE	Ammunition Ship
AF	Store Ship
AFS	Combat Store Ship
AG	Miscellaneous
AGDE	Escort Research Ship
AGEH	Hydrofoil Research Ship
AGER	Environmental Research Ship
AFG	Miscellaneous Command Ship
AGM	Missile Range Instrumentation Ship
AGMR	Major Communications Relay Ship
AGOR	Oceanographic Research Ship
AGP	Patrol Craft Tender
AGS	Surveying Ship
AGSS	Auxiliary Submarine
AGTR	Technical Research Ship
AH	Hospital Ship
AK	Cargo Ship
AKD	Cargo Ship Dock
AKL	Light Cargo Ship
AKR	Vehicle Cargo Ship
ANL	Stores Issue Ship
AO	Net Laying Ship
AOE	Oiler
AOG	Fast Combat Support Ship
AOR	Gasoline Tanker
AP	Replenishment Oiler
AR	Transport
ARS	Repair Ship, Salvage Ship
AS	Submarine Tender
ASPB	Assault Support Patrol Boat
ASR	Submarine Rescue Ship
ATA	Auxiliary Ocean Tug
ATC	Armored Troop Carrier
ATF	Fleet Ocean Tug
ATS	Salvage and Rescue Ship
AV	Seaplane Tender
AVM	Guided Missile Ship
CA	Heavy Cruiser
CC	Commander Ship
CCB	Command and Control Boat
CG, CGN	Guided Missile Cruiser
CL	Light Cruiser
CLG	Cruiser

(1) In your job would you ever have to perform reading tasks using material like this to look up facts?



(2) How *frequently* do you perform a reading task similar to this?

1	2	3	4	5
1 to 3 times a year	1 time each month	2 to 3 times a month	1 or more times each week	Daily

(3) What might be the consequence of a reading error with this type of reading task?

1. No consequence
2. I would be disciplined and some time would be wasted.
3. The job would have to be done over again and some time would be wasted.
4. The job would have to be done over and some material would be wasted.
5. The job would have to be done over and some people would be inconvenienced.
6. Equipment would be damaged or lost.
7. I might be injured or other personnel might be injured.

Figure 8. **Sample Page From Navy Job Reading Task Inventory**

All ships are assigned *designations*—a group of letters which indicate their type and general use—and *hull numbers*, which are usually assigned in sequence to ships of a type as they are built. These identifying designations are used in correspondence, records, plans, communications, and sometimes on ships' name—*Mission Capistrano*, (AC 162)—and help to avoid confusion between such similar names as *Home* (DLG 30) and *Hornet* (CVS 12) or *Phoebe* (MSC 199) and *Phoebus* (YF 294).

The first letter in a designator is a general classification: *D* for destroyers, *S* for submarines, *L* for amphibious vessels, *M* for minewarfare vessels, *A* for auxiliaries, *W* for Coast Guard vessels, *T* for Military sealift command ships, and *Y* for service and yard craft. In combatant designations, the letter *N* means nuclear powered and *G* means the ship is equipped to fire guided missiles. A listing of most ship designations follows; minor yard craft and service craft have been omitted.

AD	Destroyer Tender	AO	Net Laying Ship
ADG	Degaussing Ship	AOE	Oiler
AE	Ammunition Ship	AOG	Fast Combat Support Ship
AF	Store Ship		
AFS	Combat Store Ship	AOR	Gasoline Tanker
AG	Miscellaneous	AP	Replenishment Oiler
AGDE	Escort Research Ship	AR	Transport
AGEH	Hydrofoil Research Ship	ARS	Repair Ship, Salvage Ship
AGER	Environmental Research Ship	AS	Submarine Tender
AFG	Miscellaneous Command Ship	ASPB	Assault Support Patrol Boat
AGM	Missile Range Instrumentation Ship	ASR	Submarine Rescue Ship
AGMR	Major Communications Relay Ship	ATA	Auxiliary Ocean Tug
		ATC	Armored Troop Carrier
AGOR	Oceanographic Research Ship	ATF	Fleet Ocean Tug
		ATS	Salvage and Rescue Ship
AGP	Patrol Craft Tender		
AGS	Surveying Ship	AV	Seaplane Tender
AGSS	Auxiliary Submarine	AVM	Guided Missile Ship
AGTR	Technical Research Ship	CA	Heavy Cruiser
AH	Hospital Ship	CC	Command Ship
AK	Cargo Ship	CCB	Command and Control Boat
AKD	Cargo Ship Dock		
AKL	Light Cargo Ship	CG, CGN	Guided Missile Cruiser
AKR	Vehicle Cargo Ship	CL	Light Cruiser
ANL	Stores Issue Ship	CLG	Cruiser

NAVY READING TASK TEST/INVENTORY—RESULTS OF EXPLORATORY STUDY

Type of Task: Following Directions Using Texts and Tables (Form E, Item 16)

Question: *Situation* – You are on watch and have been told to report all ships that you see. When reporting, you have been told to first give the ship's general classification and then the designation. You have sighted a light cargo ship.

What do you report?

Test Results: Percentage of personnel at each reading grade level who got the correct answer.

READING GRADE LEVEL

	6	7	8	9	10	11	12	13	14	TOTAL
N	10	8	7	8	11	8	7	6	17	82
%	40	50	86	62	55	62	71	83	82	66

Inventory Results: Frequency with which this type of task is performed.

	1 1 to 3 times a year	2 1 time each month	3 2 to 3 times a month	4 1 or more times each week	5 Not Daily Used
Electronics Technician		x			
Electrician's Mate				x	
Gunner's Mate					x
Boatswain's Mate					x

Figure 9. **Performance of Personnel of Various Reading Grade Levels of Ability on a Test of Following Directions Using Text and Tables**

Figure 9 also shows the test results (the percentage of personnel at each reading grade-level who got the correct answer to the test item). We see that 10 persons read at the sixth grade level, and that 40 percent of those 10 answered the question correctly, using the material on the left side of the page. (In the actual test, the material was in the Bluejacket's Manual. Examinees were given page references, and then had to locate the material in the 617-page manual. By using the intact Bluejacket's Manual we hoped to obtain greater fidelity to the actual job-related reading situation.)

Results on the frequency of use of the material in the inventory format are also presented in Figure 9 at the bottom of the right side of the page. In our exploratory work, only four persons from four jobs tried out the inventory; the frequency of use reported by these persons differed for this type of material. Obviously, large numbers of personnel are needed to obtain a reliable, normative view of the performance of variance reading tasks in different jobs.

Figure 10 shows how general reading skill is related to performance on the job-related reading tasks considered as a set. The percentage of test items on which 50

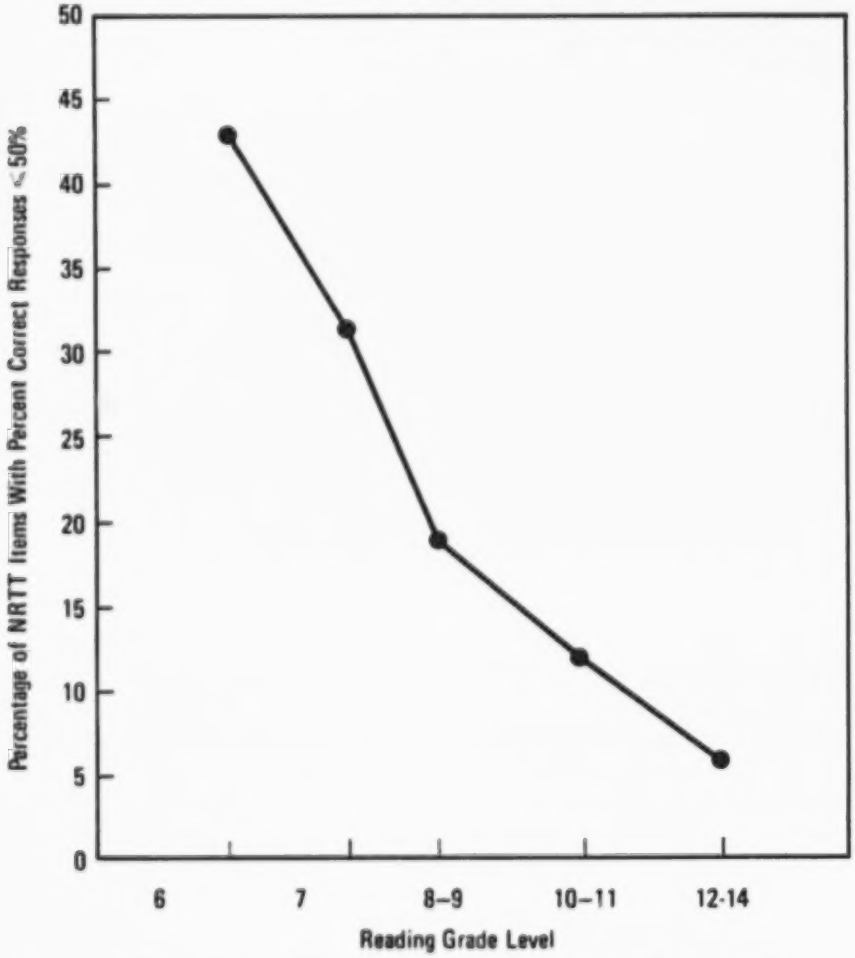


Figure 10. **Percentage of NRTT Items for Which Correct Responses Were Obtained by 50% or Less of the People at a Given Reading Grade Level on the Nelson-Denny Test**

percent or fewer of the examinees scored correctly is plotted for each reading grade-level group. For all of the reading tasks attempted by sixth grade level readers, 42 percent of the tasks had accuracy rates of 50 percent or lower. The proportion of reading tasks having this low accuracy rate decreased to six percent when averaged over persons with 12th-, 13th-, and 14th-grade reading levels. Thus, the probability that more than half of the people at a reading grade level of skill will be able to perform a given reading task shows a 36 percent increase from the sixth grade level of reading skills to the 12-14 grade levels.

These data are relevant to the question of whether the types of literacy skills developed in the schools actually prepare people to perform the types of literacy tasks encountered in jobs. The answer is clearly "yes"—if the school-taught skills are actually learned. People who read at the 12th grade level had little difficulty performing these Navy reading tasks. Indeed, many persons reading at the sixth grade level successfully performed many job reading tasks—58 percent of the reading tasks had more than 50 percent of the readers at that level performing the task correctly.

To identify the reading demands of any Navy job, using this inventory approach, one would first administer the inventory to job incumbents to determine frequency and criticalness of performance for each reading task. Then, to determine the reading grade-level of difficulty for each type of reading task in the inventory, the job analyst would consult expectancy tables which showed how well people of different reading grade-levels performed on the reading task.

At this point, a management decision would have to be made about what percentage of people should be able to perform the reading task. If it were determined that only 40 percent of the people should be able to perform the task, then, using the example of Figure 9, a sixth grade level of reading skill would be deemed sufficient, and the task would be assigned a sixth grade level of difficulty. However, if it was determined that 80 percent of the people should be able to perform the task, then in the example of Figure 9, it would be placed at the 13th-14th grade level, where 80 percent of the persons got the item correct. (It is assumed that, with larger numbers of persons taking the test, fluctuations in the percentages correct as a function of reading-skill level would be greatly reduced. Here we have regarded the 86 percent correct for eighth grade readers as a sampling fluctuation, to be ignored.)

To determine the reading difficulty for a job, the reading grade-level of each reading task would be weighted by its frequency and criticalness. These weighted figures would be summed, and the average, weighted reading difficulty level would be computed. The resulting average reading grade-level would be the level of general reading skill that is needed, on the average, to perform the reading tasks of a given job.

There are difficulties with the task analysis method for identifying reading demands of jobs, as there are with any such effort (Sticht and McFann, 1975). However, I believe the approach can, with some refinements, offer useful information about the reading demands of jobs and contribute to the development of more useful vocational literacy training programs, thus permitting higher levels of vocational competence.

The following section illustrates the application of this approach to the design of job-related literacy programs for the armed services. The research integrated literacy and job technical skills training so that both types of training were given at the same site during the same training day with no increase in the overall training time. In the first phase, research demonstrated that job-related literacy training can be developed which integrates the teaching of job knowledge and literacy. Two literacy programs were developed, one of which, like traditional literacy programs, was conducted as an add-on to the regular training sequence. The second phase of research demonstrated that the job reading training could be integrated into the job technical skills training program without adding to the overall training time.

PART V:

DEVELOPMENT OF TWO JOB-RELATED LITERACY PROGRAMS

Two projects attempted to relate job and literacy skills training. One project, conducted for the Army (Sticht, 1975b), produced a 6-week job-oriented literacy training program to be given after basic military training and before job technical skills training. A second project, conducted for the Air Force, produced a job-oriented program for personnel at their duty station (Huff et al., 1977). Job incumbents attended this program for two hours a day to prepare them for performing job reading tasks and correspondence course training more effectively.

Both the Army and the Air Force programs use materials and content taken directly from job skills training programs and from job manuals and other job performance aids. Instruction in reading and learning of these materials is presented in both programs by means of two curriculum strands:

Strand I — Reading-to-Do. This strand provides extensive drill and practice in fact finding and following directions in job reading materials. The Army program provides practice in six modules: using tables of contents, indexes, and tables and graphs; looking up information in the body of a manual; following procedural directions; and filling out job forms. The Air Force program, being aimed at a somewhat higher level reader, omits the practice in using tables of contents and indexes. In the remaining four modules, it provides training similar to the Army program. It should be recalled that the actual materials and content differ in the two programs, and are taken from job reading materials used in the particular Service.

Each job-reading module is accompanied by a Pre-Proficiency Test (Pre-PT) and a Post-Proficiency Test (Post-PT) which determine eligibility for the module training, and mastery in terms of both accuracy and time scores.

Each module consists of source materials and numerous worksheets which require that the student perform the tasks indicated by the module name. The worksheets were designed to emphasize three factors: structure, content, and difficulty.

A structural worksheet causes the student to notice how an information source/display is put together (e.g., a table may have rows, columns, headings, etc.). Specific questions require the student to process information about structural features.

A content worksheet causes the student to attend to the content of an information display (e.g., a procedural direction worksheet might ask a person to locate a specific step in a given display).

The difficulty dimension is incorporated into both structural and content worksheets. Essentially, the worksheets start with easy questions and gradually become more difficult—in terms of the information to be presented or the amount of paraphrasing, which makes the student use vocabulary.

In essence, then, the reading-to-do strand provides extensive practice in applying whatever reading skills a person has to the performance of fact finding and following directions tasks involving the types of materials the person will encounter in job skills training or on the job.

Strand II — Reading-to-Learn. The reading-to-learn strand contrasts with the reading-to-do strand in being concerned with the processing of information for future

use. Hence it emphasizes the development of strategies for learning from written texts. To process information for learning, people must be prepared in at least two ways; they must have a knowledge base which they can bring to bear in comprehending the material to be learned, and they must possess skills for studying materials and relating what they read to what they already know.

The reading-to-learn curriculum includes specially developed materials to promote the acquisition of a relevant knowledge base which would help literacy students learn better from their job training materials. These materials are written at a lower difficulty level than those encountered in job training, and incorporate the basic concepts and topics within a given job career field.

For the Army program, the basic concepts in six job career clusters were identified through study of job skills training program curriculum guides, and consultation with instructors. In each job cluster, 12 major concepts were identified, and specific knowledge objectives were developed for each concept area. For each concept, a 300-400 word passage was written which included the knowledge objectives for the concept. These passages were written at the seventh to ninth grade levels of difficulty, in contrast to the actual job materials, which are written at the 11th-grade level and above.

Similar concept passages and knowledge objectives were developed for two career clusters in the Air Force program. In this case, since higher ability students were enrolled in the Air Force program, passages were about 1000 words in length, and of 9th and 10th grade difficulty.

The concept passages were written without the redundancy and elaboration usually needed to explicate concepts in written materials, because in the reading-to-learn activities each student reads the materials repeatedly and constructs various representations of the messages in the passages. For instance, in some cases students read the concept passages and then draw pictures of what they have read. In other cases students read the concept passages and then produce classification tables or flow charts representing the concept presented. Having transformed concept passages into pictures, classification matrixes, or flow charts, students then discuss their newly developed representations orally, thus producing another representation transformation.

This representation transformation process produces cognitive elaboration of job concepts, which helps the student learn job knowledge that can then be used in comprehending job reading materials. At the same time, the student is learning analytical tools for dissecting written passages and reorganizing them, by superordinate and subordinate categories in the case of classification tables, and by sequential steps and decision branching points in the case of flow charts. These learning strategies help to clarify what written passages are all about, and in the process they engage the reader in the cognitive elaboration required to learn the job knowledge.

The instructional methods for the reading-to-learn curriculum strand includes small group work, in contrast to the individual work of the reading-to-do strand. In the reading-to-learn strand, students may work alone or together to produce a representation transformation. In a full day program, such as the Army program, this adds needed variety to the day's activities.

In addition to the representation transformation activities, the reading-to-learn program for the Army includes special instruction in how to analyze sentences into the main idea and more about the main idea. This instruction was developed for the lower level Army readers when it was discovered that many of these students had difficulty in figuring out who was doing what to whom or what in many sentences. This type of training was not provided for the more advanced Air Force students.

Evaluation of the Job-Related Reading Programs

Several approaches were used to evaluate the effectiveness of the job-related reading programs. For both the Army and Air Force programs, summative evaluation data were obtained by pre- and post-programs tests of general reading and job-related reading. Formative evaluation data were obtained from the pre- and post-module proficiency tests of the Strand I reading-to-do program. Formative data for the reading-to-learn strand were obtained for Army personnel in a small-scale study in which specially constructed representation transformation tests were administered pre- and post-training in the reading-to-learn activities.

In addition to the direct evaluation of training effectiveness, the Army program was further evaluated by comparing the summative pre- and post-training general and job-related reading test data with such data obtained by a group of Army personnel in technical training who had received no literacy training, and with similar data obtained by Army and Air Force literacy students in programs teaching only general literacy, not job-related literacy.

Finally, in addition to the test score data, questionnaires were used to obtain information from Army and Air Force students on their perceptions of the value of the job-related literacy training in improving their literacy skills, and from Air Force supervisors about their perceptions of the effects of literacy training on Air Force students.

In the following discussion, formative evaluation data for the reading-to-do module are discussed first, followed by the reading-to-learn formative data. Next, the summative evaluation data for the Army and Air Force programs will be discussed, followed by a brief description of the studies comparing the summative data for the Army job-literacy program with the no literacy training and general literacy training groups. The questionnaire data are summarized last, just before we turn to a discussion of the fully integrated job literacy and technical training program.

Formative data for reading-to-do. The pre- and post-proficiency test scores for the reading-to-do modules of the two programs are presented in Table 2. No data are presented for the Forms modules because in these modules each form served as its own pre- and post-test, and training consisted simply in practicing filling out the form.

Regarding Column 5 (Did Not Complete), many students were not able to progress at the rate needed to master the criteria for each proficiency test, which were to obtain 90 percent accuracy within a 20-minute time period (see Sticht, 1975b for the development of these criteria). In these cases, students were moved into the next module anyway so they could obtain practice in those job-related reading tasks before the 6-week training period ended. Since the modules do not represent a hierarchy, no cumulative learning problem results from this practice.

As Table 2 indicates, training effectiveness (the percent reaching criterion divided by the percent attempting the module) was better for the Army than for the Air Force program. This difference probably reflects the differences in the number of hours of training time. Army personnel attended class for six hours a day for six weeks, while Air Force personnel attended class for only 2½ hours per day for six weeks. (See Koehler, 1978 for a discussion of the effects of time-on-task on learning.) Both the Army and the Air Force reading-to-do modules appear to bring about considerable improvement by the students who worked through the modules.

Formative data for reading-to-learn. A small-scale study evaluated the effectiveness of the reading-to-learn strand of activities. Thirty-six students in the Army literacy

Table 2

**Performance on Strand I:
Reading to Do Modules in Job-Related
Reading Programs for the Army and Air Force**

(1) Module	(2) N	(3) Passed Pre-Test (%)	(4) Passed Post-Test (%)	(5) Did Not Complete (%)	(6) Training* Effectiveness (%)
Army Program					
Table of Contents	710	19	67	14	83
Index	710	16	56	28	67
Tables & Graphs	710	20	53	27	66
Body of Manual	710	3	49	48	48
Procedural Directions	710	9	30	61	33
Air Force Program					
Tables & Graphs	92	12	28	60	32
Body of Manual	92	10	21	68	23
Procedural Directions	92	17	32	51	39

*Column 4 divided by columns (4 + 5) equals the training effectiveness.

program were administered representation transformation tests in which the student transformed a prose passage into either a classification table or a flow chart. An example of the test for the classification table is presented in Figure 11. At the top of each test is an example of a text; below that is a representation of the text transformed into a table. Then there is another passage of text. The student is supposed to transform information in this passage into the type of classification table shown in the top half of the page. In other words, this is an analogies problem; text A is to classification table B, as text C is to a table, D, to be constructed by the student. A similar test was constructed for the flow chart transformation task.

Mean pre- and post-test scores changed from 65 to 95 percent correct on the classification test, and from 37 to 61% correct on the flow chart test. The pre- and post-test administration was separated by not less than four weeks to reduce the likelihood that a simple practice effect might have produced these gains—a possibility since the pre- and post-tests were exactly the same. Given the difficulty the literacy students had in learning most tasks, even with extensive practice, simple practice effects or recall from the pre-test seem most unlikely. Thus, these data suggest that the representation transformation (learning strategy) training did improve students' skills in making such transformations.

Summative evaluation of the two programs. Pre- and post-training test data for entry into and exit from the two programs are shown in Table 3. Scores are given in reading-grade levels for both the general and job reading task tests, with the latter reading-grade levels established through small-scale norming studies relating job and general reading test performance.

Types of Bars A

Crowbars are used for moving timbers and rocks. They are available in 4 and 5 foot lengths with a diameter of 1 or 1-1/4 inches. Pinch bars are from 12 to 36 inches long and are used for prying out spikes and nails. Pinch bar diameters range from 1/2 to 1 inch depending on their length. Wrecking bars have diameters of 1/2 to 1-1/8 inches and are available in lengths from 12 to 60 inches. They are used for the same things as crowbars. Pry bars are used for prying out gears and bushings. They are 16 inches long and have a diameter of 1-1/16 inches.

B

Type	Use	Length	Diameter
Crowbar	Moving timbers and rocks	4-5 feet	1 or 1-1/4 inches
Pinch bar	Prying out spikes and nails	12-36 inches	1/2 to 1 inch
Wrecking bar	Moving timbers and rocks	12-60 inches	1/2 to 1-1/8 inch
Pry bar	Prying out gears and bushings	16 inches	1-1/16 inches

When You Are Lost — Eat Plants C

If you are lost and out of food there are many types of plants that you can eat. Marsh marigolds are best during early spring. They are found in swamps and in streams. The leaves and stems are the only parts that you should eat. The leaves, stems, and flowers of the rock rose are all good to eat. You can find them along streams and lakes in early spring. Fireweed is also good to eat. It is usually found in burned-over areas during spring and summer. You can eat the leaves and flowers of the fireweed but not the stem. The roots of the mountain willow are also good to eat. Mountain willow is found in high mountains in early summer.

D

STUDENT CONSTRUCTS TABLE

Figure 11. **The Classification Table Representation Transformation Test From the Army Job-Related Reading Program**

Table 3

Summative Reading Improvement Data for Students in Army and Air Force Job-Related Reading Programs

Test Score	General Reading*		Job-Related Reading*	
	Army	Air Force	Army	Air Force
Entry	5.3	9.2	5.2	10.2
Exit	6.0	9.7	7.3	11.3
Gain	0.7	0.5	2.1	1.1
N	714	93	714	93

*Scores are expressed in reading grade levels.

In both programs, job reading gain was much larger than general reading. This is important because it indicates that people are learning what they are being taught. In many evaluation studies, standardized reading tests are used to evaluate programs, with no good rationale as to why it is believed the test scores should change. Usually, there is no demonstration that the standardized tests reflect what is being taught. Clearly the present results show that "reading" is not altogether a generic skill, assessable by any test or "general" reading.

The job reading task test results show that specific literacy skills can be developed and assessed for generalizability in the domain area which corresponds to what was taught. The latter point is demonstrated by the fact that performance on the job reading task tests improved even though the specific content and questions asked were not included in any training module.

These data suggest that, although students with high levels of reading skills are able to perform job reading tasks well, as indicated in Figure 10, it is not necessary to develop high levels of general literacy in job-related literacy programs for adults in order to improve their ability to perform job-related reading tasks. The latter are most efficiently taught by direct instruction in performing such tasks.

Additional evaluation data. The job literacy training achievements of Army literacy students were compared to reading improvement by a group of Army personnel who received job technical skills training, and hence exposure to Army reading, but no job literacy training per se. Results showed superior gains for the job-related reading trained group, which improved 2.6 years to the other group's 1.1 years in job-related reading test performance. Similarly, comparisons of the job-related literacy trained groups with students in Air Force and Army general literacy programs indicated that the job literacy training produced two to four times as much improvement in job reading skills as the general literacy programs did, and equaled the general literacy programs in general reading test score improvement.

Further indication of the effectiveness of the Army programs was obtained by feedback from graduates who had gone on to job skills training. Although, of 353 follow-up questionnaires, only a disappointing 74 (20%) were returned completed, eight out of ten who answered felt that the job literacy training helped them in their job training. Several suggested additional activities to be included in the literacy training for their job.

In the Air Force program, 60 percent of personnel who completed an end-of-course questionnaire reported that they felt more confident in their ability to read and understand their job reading materials since taking the literacy training. Two-thirds of the supervisors of the students reported that the job-oriented reading program had made some or very much improvement in the person's job performance.

Thus, the results of module tests, pre- and post-summative tests, and end-of-course and follow-up questionnaires indicate that improvements in job reading skills resulted from participation in the functional literacy programs. This indicates that it is feasible to integrate literacy and job skills technical training, at least in terms of content.

Integrating Job Technical and Literacy Skills Training

The foregoing projects showed that job-related literacy training produced gain in general literacy comparable to other literacy programs and was more effective in improving job reading skills than the programs the services were offering, and hence is more cost-effective because it is no more costly than the general literacy programs. However, the job-related programs still required that a separate training program be established and that people be specially assigned to the program for an extended period of time. It remained to be demonstrated that the literacy and job technical skills programs could be fully integrated into the same training day and at the training site. Such a demonstration was accomplished in further work for the Army (Sticht, 1975b).

To integrate job technical skills training and job-related literacy training, a two-step process was followed in an exploratory study involving one Army job: the Supply Clerk. In this research, the Supply Clerk's training program was first converted to a self-paced instructional program by Hungerland and Taylor (1975). They found that, in the lock-step course, students were held in the program for 35 training days while the average time in the self-paced course was 25 days, with a range from 13 to 44 days. Only seven percent of the self-paced trainees required additional time to complete course requirements. All graduates of the self-paced course met the same end-of-course test criteria used in the regular, lock-step course.

Following demonstration that the Supply Clerk's training program time could be significantly reduced, in numbers of person-hours, the second step was to incorporate job reading training into the Supply Course for those who had difficulty in performing job reading tasks. To incorporate reading training into the Supply Clerk's course, the clerical material from the Army job reading program was modified to focus exclusively on the Supply Clerk's materials. Reading training was provided for two hours per day. Results showed that performance on the job reading tests rose from an average reading grade level of 5.5 before training to 7.2 after training.

This experience suggests that it is feasible to introduce job skills training and job reading training within the same training day without adding to the overall training time of traditional lock-step job skills training programs. And it is possible to make significant improvements in job reading skills and job technical skills during this integrated training program. Since this approach also deletes the need for a 6-week add-on to the regular training "pipeline," it is a more cost-effective way to provide literacy training.

Institutionalizing the Job-Related Reading Approach

Though successful in demonstrating that job-related literacy training is more efficient than general literacy programs in improving the ability of personnel to perform

job reading tasks, the job literacy training research also indicated that, even with literacy training focused directly on job-related reading, many personnel achieved only modest gains in skills, while others did not improve, at least to any measurable extent. Thus it seems likely that, for those who enter the services with very low levels of literacy, the achievement of large, long-lasting improvements in literacy skills will require a long-lasting development effort.

As reported by Sticht et al. (1976) in the Navy research, a long-lasting development effort would have to involve a greater degree of cooperation and interrelatedness, at policy and content levels, of the military's counseling, educational, and job technical skills subsystems. This could permit a continuing program of development for less literate personnel that relates to the requirements for literacy in the initial environment encountered upon entry into the service, during technical skills training, and at the duty station.

Taking cognizance of this research, the General Accounting Office (1977) recommended to the Department of Defense that, if remedial programs are to be continued, the services should:

> ". . . make certain that they are integrated with (job technical) skill training, career counseling, and general education development . . ."
>
> (pp. ii - iii)

Consistent with the demonstration of the relative effectiveness of the job-related literacy approach, and the need for a more systematic, developmental sequence of literacy training, both the Secretary of the Navy and the Secretary of the Army have formulated policy directing that on-duty literacy programs will be of a job-related nature.

Following this guidance, the Navy offers Academic Remedial Training (ART) at its three basic military training bases, incorporating training-related literacy demands of basic military training. Additionally, the Navy Personnel Research and Development Center (NPRDC) has developed the Job-Oriented Basic Skills (JOBS) program to provide job-related literacy skill development for Navy personnel following basic military training but before job technical skills training, much as did the experimental Army program described above (Harding et al., 1980).

Evaluation of the JOBS program has extended the previous evaluations of job-related reading in the Army and Air Force by following JOBS students from the literacy training program through technical training. Results to date indicate that JOBS graduates who entered technical school had an attrition rate 32 percent lower than personnel of comparable literacy skills who did not receive the JOBS training (E. Aiken, Navy Personnel Research and Development Center, personal communication, June 1981). As a result of these findings, the Navy has decided to extend JOBS training to a wider variety of technical fields.

The Army, acting under policy guidance issued in 1980 by the Secretary of the Army and the Army Chief of Staff, has initiated a 6-year research and development project to develop job-related basic skills programs that will provide basic skills development at entry into the Army, during technical training, and at the duty station. This program involves, among other things, the development of job-related literacy programs to teach the basic skills prerequisites for nearly 100 Army jobs. The Army includes as basic skills not only the traditional skills of reading, writing, and arithmetic, but also learning strategies of a general nature (O'Neil and Spielberger, 1979) and skills for coping with literacy and other cognitive demands of tasks encountered in general Army life (Department of the Army memorandum, Subject: Implementation of Army Continuing Education Policy and Recommendations Plan, 7 January 1980).

As these examples illustrate, the Army and the Navy are undertaking an extensive set of activities to produce a more effective literacy development component of the human resources acquisition, development, and utilization systems in these services. Policy guidance has been issued and projects are under way to develop job-related literacy training. Now additional work is needed on methods for system integration: methods for more completely integrating job technical training and literacy training so that personnel are not sent away to what is too often referred to as "dummy" school; methods for counseling and scheduling to ensure that personnel who enter at low levels of literacy skill are successively enrolled in each level of literacy training; methods for measuring and indexing continuous development in literacy and learning strategies that go beyond the "reading grade level" scale which is simply unsuitable for indexing increments of job-related literacy in adults; and methods for articulating job-related literacy training and development of skills for coping with military life with high school completion requirements, so that both the military's competence and the person's credentials requirements for promotion to higher ranks and levels of responsibility can be met.

Applications to Civilian Settings

There are, today, the beginnings of a transfer of the concepts and techniques for developing integrated basic skills and job technical training from the military to civilian settings. At Indiana University, Dr. Larry Mikulecky and associates have recently described integrated basic skills and job skills programs that they developed for word processing and wastewater treatment workers (Mikulecky and Stranse, 1982).

At the University of Minnesota, adult education Professor Dr. Rosemarie Park has initiated college courses to teach adult and vocational education teachers how to integrate basic skills and job skills training, and she has assisted a number of businesses and industries in moving in the direction of integrated basic and job skills training (personal communication, January 1983). Additionally, the Polaroid Corporation has, for some years, offered job-related basic skills programs for employees (personal communication from Rosalyn Stoker of Polaroid's Cambridge, Massachusetts office). These efforts, though small in numbers and scale, suggest that it is, indeed, possible to transfer the concepts and techniques developed in the military to civilian job settings (Datta, 1983, p. 167).

In the field of adult basic education in general, the last decade has witnessed a major shift away from the strictly academic credentials-oriented programs to programs that focus on the needs of adults. Stimulated largely by the Adult Performance Level study conceived and funded by the Division of Adult Education of the U.S. Department of Education, the Adult Performance Level project has led to the development of many programs that integrate basic skills education with the content knowledge needed to cope with the large variety of problems that adults encounter (Adult Performance Level Project Staff, 1975). Thus, it is a much smaller step, today, to move toward integrated basic skills and job skills training for adults because the adult education establishment is knowledgeable of and committed to such "functional," "competency-based" education for adults. And in some cases the functional, adult-oriented programs have been certified as largely satisfying the requirements for a high school diploma (Adult Performance Level Project Staff, 1979). Thus, integrated basic skills and job skills training in business and industry might also provide access to the much needed credentials for working and for advancement in career paths.

Given the continued reporting of data that show the importance of parent (especially, the mother's) education on the school achievement of their children (e.g., Profile of American Youth, 1982; Laosa, 1982); the existence of proven technologies, including new computer-based programs that the military has developed for integrating basic skills and job skills training (Farr, 1983); and adult educators committed to functional education for youth and adults, the time appears propitious for reexamining our policies and practices for interrupting the intergenerational cycles of marginal living and marginal learning. Today, the predominant approach is, in effect, to write-off as lost causes youth and adults who have not learned the basic skills well, and to place billions of dollars in remedial money in school-based programs for their children.

It may well be that a commitment to the continued development of youth and adults, that matches our commitment to the remediation of their children in preschool and elementary school programs, would pay double rewards. Through education of the adults, we might also improve the educability of their children.

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